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A LESSON IN LANGUAGE BY THE NEW TEACHER
FRONTISPIECE (Photography Applied to Advertising)

**Complete Self-Instructing Library
of Practical Photography**

VOLUME IX

**Commercial, Press,
Scientific Photography**



J. B. SCHRIEVER
Editor-in-Chief

Popular Edition

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CHAPTER I.

Commercial Photography.

Introduction.

1. During the earlier years of photography—while it was, as we might say, in its experimental stages—portraiture and landscape, with occasional flights into scientific fields, were the beginning and end of the photographer's endeavors.

2. In those days, the publisher, the advertiser and the manufacturer were dependent on the black and white artist for their illustrations; the newspapers had not yet educated the public to news-pictures taken but an hour or two, or at least, a few hours, before; the travelling salesman was yet hampering his movements from city to city with huge cases of samples, instead of carrying in his grip a few portfolios of photographs of his goods; the daily growth of a monster building or a railroad could be shown only by the written reports of the engineer in charge; damage cases in court, trials for forgery or murder were all dependent on verbal evidence; the art auctioneer could only offer the more expensive but generally less reliable wood-cut in his catalogue-de-luxe, and so on throughout the realms of art and business.

3. Today, this is all changed. Without the camera, the lens, and the sensitized plate and paper, the business of the world, the amusements of a large part of the population, the instruction of the school children, the expeditious selling of material and the spreading of news, would be vastly hindered, if not at a standstill.

4. The constant improvement in photographic apparatus, lenses and material has made photography of use, and

in most cases a necessity, in every branch of human endeavor—scientific, commercial and artistic.

5. While photography, in its earlier years, was classed amongst the luxuries, today not even the strictly portrait photographer will admit that he caters to a fad, while the so-called commercial photographer, the man who specializes in everything but portraiture, from the photographing of a tombstone to the flashlighting of a princely banquet, is a necessity and is to be found in every hamlet. His activities extend to anything and everything that has to be put in permanent, preservable shape, or quickly converted into pictorial form for public use. And it is a field, too, which will never become exhausted, but, on the contrary, grows daily in its variety and needs.

6. Commercial photography comprises all those manifold phases of picture-making which fall outside the domain of the portrait or landscape photographer. News-pictures; photographs of buildings, machinery, manufactures of every nature, from delicate laces to elaborate curtains and rugs, from fancy bric-a-brac to the product of the piano-maker; pretty posings for advertisers; interiors of work-shops or palaces; instantaneous views of speedy trotters or prize cattle—anything not strictly portraiture is the commercial man's share.

7. A volume could be filled in merely enumerating the various subjects, but a general summary of the work and the different demands made on the photographer's skill is all that is necessary here. The knowledge gained from the instruction given in the following pages will enable the student to undertake any other class of work not specially mentioned herein.

8. Commercial photography deals more particularly with the technical side rather than the artistic, but the lessons already learned in handling apparatus and lenses, in obtaining lightings, in retouching, printing and finishing, all apply equally to portrait or commercial work. The methods are the same, but the technique and the conditions are slightly different.

9. It is absolutely necessary in commercial photography to secure a perfectly accurate reproduction of the original, and in doing this, detail must exist in all portions of the picture, and the perspective should be perfectly true and accurate. In other words, sufficient illumination must be had and the proper amount of exposure given, to produce good, clear detail. To avoid distorted perspectives a lens of long focus, or one which will give a narrow-angle view, should always be used.

10. The portrait photographer has but few principles to learn and apply, as compared with the commercial worker, for the latter has to deal with all kinds and classes of subjects, situated practically under any form of light, and this adds difficulties with which the portrait photographer does not have to contend. In both cases, however, the field is unlimited in its scope, and to this same extent is the amount of practical training necessary to make one thoroughly proficient. The individual ideas of the photographer, as well as his own ingenuity, both in portraiture and in the commercial field, go far toward making him a master of his work, and, therefore, a *success*.

11. In almost all of the different branches of commercial photography the greatest accuracy is essential. This is especially important where the object being photographed contains lines, such as interiors, furniture, machinery, exteriors of buildings, etc.

12. Depth of focus and the securing of a clear, perfectly sharp image must not be sacrificed for exposure. Without giving any consideration to the increase of exposure, the lens should be stopped down far enough to secure the required depth of focus and sharpness of image.

13. Detail is another feature which must not be slighted. The lighting should be such as to illuminate the subject to the best advantage, and the exposure sufficient to give detail in the most dense shadows. As the majority of objects to be photographed are stationary, there is no excuse for under-exposure. On the other hand, extreme over-exposure should be avoided, as the negative must not

be fogged, which would be the case if exposure were carried to the extreme. What is required is a negative full of detail, snap and brilliancy, and one which will give a good strong print with detail in the high-lights, detail in the shadows, and an excellent range of gradation between these two extremes. The shadows must not be lifeless and lacking in detail, nor should the high-lights be hard and chalky.

14. It is necessary to reproduce exactly what is seen in the original and give the observer an absolutely accurate idea of the subject. Further than this, for objects out-of-doors, whose high-lights and shadows are important and necessary for the success of the picture, the time of day and the weather conditions should be taken into account, and such lighting effect secured as to show the building, or photographed object, to its best advantage. To such a perfect degree must the technical side of photography be understood, that the object will be reproduced exactly as it exists, and yet give a pleasing and effective result.

15. For advertising purposes, in particular, detail and accuracy in a photograph from the original object are of paramount importance. The dealer or manufacturer cannot, in all instances, show his customers the actual goods he has for sale and must resort to the photograph to represent them truthfully and appealingly, and the degree of perfection in the re-presentment attained will be responsible, to a great extent, for the success or failure to effect a sale of the particular article, all of which goes to prove that the commercial photographer cannot be too careful with his work, nor too well informed regarding the particular subject he has to reproduce. The best results are only attained by experience and continued practice. It will be our aim in the present volume to so cover the general principles of commercial photography, that anyone who follows the instruction with diligence will be enabled to apply these principles to any branch of commercial work that may arise, and successfully accomplish the desired results. We can supply the necessary foundation of knowledge, but the practice and the gaining of experience lie with the student.

16. **Subject Material.**—Aside from the photographing of individual subjects, such as a store window, a residence, a particular piece of furniture, etc., there are far wider fields of operation, which are very remunerative, besides being extremely interesting and fascinating. What could be more enjoyable than to make a series of photographs of vegetables and flowers for a seed catalog; a series of pictures of a particular type of residence for the architect; a series of photographs of residences for a real-estate dealer; a collection of photographs of stained-glass windows for the manufacturer of them; a series of photographs of fowls for the catalog of a bird fancier; the exterior view, as well as a large number of interiors of a factory, to illustrate its working equipment, and, incidentally, to be used in a catalog; a series of photographs of various styles of trunks, valises, etc., for the manufacturer of leather goods, to illustrate a catalog; a series of photographs of glassware, furniture, etc.? There is an endless number of subjects which may be classified, all requiring the services of the photographer in order to reproduce the articles most truthfully and show to the purchaser the actual appearance of the various articles for sale.

17. With the advent of the mail-order business, in which practically everything depends upon the catalog to effect the sale, the demands upon commercial photography have increased with great rapidity, until today there is not a branch of commercial life that does not, in some way or another, depend upon the photographer and his camera.

18. But, commercial photography goes still farther than this. It includes the making of post-cards, the operating of studios at summer resorts, the making of tin-types, the procuring of stereoscopic views, photographing of groups in factories and stores, securing special illustrations for catalogs, book cover illustrations, making of photographs to illustrate songs, illustrating novels, stories, etc. In fact, there is an endless field for the photographer who actually means business and wishes to make the most of his opportunity.

CHAPTER II.

Commercial Photography.

Apparatus and Materials.

19. **Cameras.**—The proper equipment for commercial work depends, to a great extent, upon the class and kind of work required. Different localities require different sized prints, and an instrument large enough to meet these requirements should be procured. For general view work an 8 x 10 camera usually answers every purpose. For general professional commercial work, however, one should be equipped with a camera capable of making pictures at least 11 x 14 inches in size. The camera should be fitted with a long bellows and have full range of movement.

20. In addition to the large camera, one should possess at least one smaller instrument, say a 5 x 7. This camera will be found very useful for small work, and convenient in many instances where a larger camera could not be used at all. An 8 x 10 instrument will often be useful, yet where the expense of instruments is considered an obstacle, the 5 x 7 and 11 x 14 will be found the most serviceable for all around work. The 11 x 14 camera may be used for 8 x 10 pictures, as well as for large work.

21. For speed photography the reflecting type of camera is to be preferred, although if one has but little of this work to do the regular view camera may be fitted with a focal plane shutter and very successful results obtained of rapidly moving objects. All cameras should have a full range of movement and be fitted with long bellows, which latter should have rings attached to different sections, to enable one to gather the bellows forward and attach to the front of the camera when normal and wide-angle lenses are

used. This will prevent the cutting off of the picture by the folds of the bellows. Some view cameras are supplied in regular equipment, with patent bellows support attached to each side of the wooden frame of the camera and to the bellows. When the bellows is drawn out, the arms of the support are pressed down, holding the bellows nearest the plate in a rigid position and preventing sag, thus avoiding cutting off of the picture. It is important to have a generous amount of rising and falling front, also a double swing-back, with a reversible ground-glass frame for both horizontal and vertical pictures.

22. For practice work a 4 x 5 camera may be employed, yet a 5 x 7 instrument is to be preferred. The initial outlay necessary for the outfit and materials, which more than proportionately increases with the size, is an item worthy of some thought. Considering the lens alone, a couple of lenses may be purchased for a 5 x 7 instrument at about the cost of one for an 8 x 10 camera. In addition to this, it is well to bear in mind that lenses of short focal length do not require the same extent of stopping down to obtain depth of focus. This allows of larger apertures being used, calling for shorter exposures, which is of considerable advantage when working in dark interiors. From 5 x 7 negatives of good quality, 14 x 17, or larger, enlargements can be made without much loss of definition. In fact, these enlargements are often difficult to distinguish from direct work.

23. **Advantage of Large Cameras.**—Larger cameras, however, have their advantages, the first of which is the greater facility offered for composing the picture on a large-size ground-glass; and second, when a lens of great focal length is used, it is easier to emphasize the sharpness of the different details of the image, if necessary to do so.

24. **Advantage of Small Cameras.**—One great advantage in using the smaller plates for practice work is, that one can make a great many more exposures, at less cost, than with the larger plates, and when a good small negative is secured it can be enlarged to any size desired. When the

serious side of commercial work is considered, however, the use of large plates will be found a decided advantage in practically every respect, and no outfit would be complete without large and small cameras.

25. **Lenses.**—That the lens be of good quality is even more important than that the camera should be a high-grade one. Owing to its depth of focus the ordinary rapid rectilinear lens is, perhaps, fully as desirable for all around commercial work as any of the more expensive types. This lens must, however, cover the plate sharply to the edges and give good definition in all parts of the subject. The anastigmat lens has its advantages when shortness of exposure and the most minute definition are essential features. Rectilinear lenses are far cheaper than anastigmat, and unless thoroughly familiar with the latter instruments and capable of handling them, it is much better to hold to the rectilinear lens. For certain classes of work, and especially for copying, the anastigmat lens, with its great covering power and flatness of field at large apertures, is superior to the rectilinear lens, but the one point against it, however, is its lack of depth of focus when used at full aperture.

26. **Doublet Lenses** are divided into two classes or groups, according to the various focal lengths which may be secured by using different combinations. Where the front and back combinations of a doublet lens have the same focal length when used separately, the lens is termed a *symmetrical* one. On the other hand, if the front combination has a different focal length from the rear combination, it is termed an *unsymmetrical* or *convertible lens*. In a *symmetrical lens* the focal length of either the front or rear combination is almost double that of the combined lens. In the *unsymmetrical lens* one of the separate combinations is almost double the focal length of the combination, while the other cell has a focal length of about one and a half that of the combination.

27. The majority of hand cameras and view outfits are fitted with either the one or the other type of lenses,

the unsymmetrical ones being a trifle more expensive than the symmetrical. All rectilinear lenses can be used either as single lenses or in combination, but anastigmat lenses are not all so constructed that their sections can be used individually. For complete information regarding lenses see Volume VI.

28. The most useful all around lens for *interior* photography is one of medium focal length, or about equal to the base of the plate on which it is intended to be used. For *exterior* photography and detail work the focal length of the lens cannot be too long, providing you have room in which to work. When it is necessary to photograph a building in a narrow or crowded street, a lens of the wide-angle type (which is one of short focal length) will be required in order to secure the subject in the position desired and obtain the effect wanted. A 5 x 7 convertible lens, having 7½-inch focal length, will be made up of two lenses having a focal length of about 11¾ inches and 14 inches, respectively. A 10-inch lens will be made up of 16½ and 19-inch lenses.

29. It is a good plan to bear in mind that one should use the longest focus lens that will include the amount of view required. The judicious use of the convertible (sometimes called trifocal) lens will assist one very materially to improve the balance of a picture much more effectively and easily than by altering the position of the camera.

30. Although wide-angle lenses are absolutely necessary in many cases, they should not be employed where one of greater focal length can be used. Although a wide-angle view is optically correct, it is always visually faulty, and for this reason a picture does not appear correct that embraces a wide angle. On account of the extreme perspective produced with a wide-angle lens the resulting picture gives the appearance of great distance or depth, and in this respect gives untruthful rendering. For instance, the interior of a narrow room, which can only be photographed with a wide-angle lens, will appear in the photograph to

be fully twice as deep as would be the case if it were possible to make a photograph with a normal-angle lens. It is often absolutely impossible to employ the normal lens,

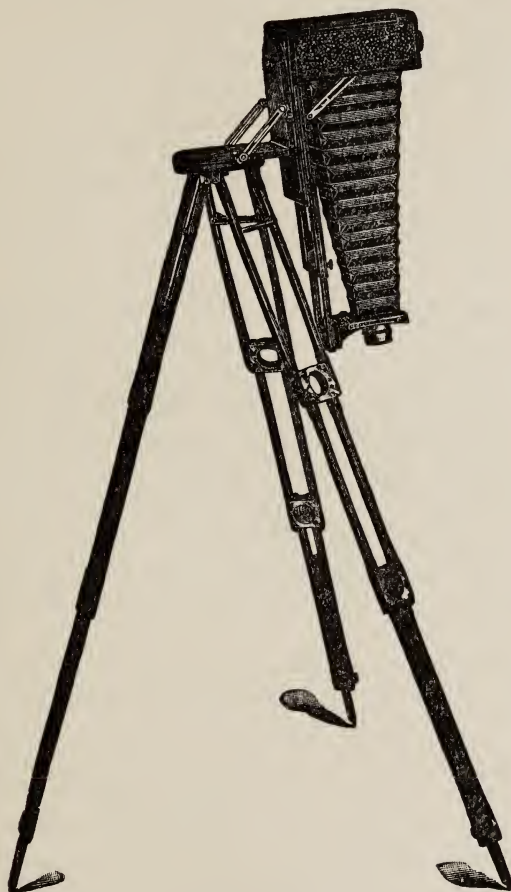


Illustration No. 1
Adjustable Tripod Head
See Paragraph 32

however, and in order to secure a photograph at all, the wide-angle type of instrument is used. It is sufficiently important to warrant the wide-angle lens being included in the commercial photographer's necessary equipment.

31. **Tripod.**—The tripod—one of the telescopic type, which permits of the legs being adjusted to any desired length—should be rigid and firm when set up. This will permit one to work on uneven ground, or to place the camera at varying heights. When working on marble or smooth surface floors or pavements, some device should be employed to avoid the slipping of the tripod legs. Pieces of cork or small rubber tips placed on each point will answer the purpose. A very convenient attachment, and one that will make the tripod absolutely rigid and free from slipping, is the wire tripod stay. This attachment is easily adjusted, being clamped to each leg by means of a thumb-screw.

32. **Adjustable Tripod Head.**—An adjustable tripod top which permits of the camera being tilted at any angle, even at right-angles to its normal position, will be a necessity for many classes of work. It will be invaluable when photographing detail work in interiors, as well as in the photographing of still life subjects which are to be arranged on the floor or table, instead of fastened to a copying-board. (See Illustration No. 1.) We might add that it is advisable to use the former method whenever possible, for then unsightly tacks or similar supports are entirely done away with.

33. **Commercial Photographer's Outfit.**—There are, practically speaking, two classes of commercial photographers. We have the commercial man who makes a business of making general views, school groups, groups of workmen, pictures of public buildings, construction work, views for post-card reproductions, small flashlight work, interior photographs, etc. For this class of commercial work, the following outfit will be sufficient:

34. One 8 x 10 long, square bellows view camera, fitted with a rectilinear or convertible lens and a good shutter, accompanied by a camera brace for long focus work; one additional 8 x 10 wide-angle lens for interior work; one good rigid folding tripod, fitted with tripod stay; one tilting tripod top; and from eight to twelve double plate-holders.

35. In addition to the above camera, you should be provided with a 5 x 7 hand camera, fitted with rapid lens and shutter, at least six to eight plate-holders, and one ordinary flash machine for small flashlight work. If a 5 x 7 anastigmat lens is used for the hand camera, this same lens can be made to answer for the wide-angle work with 8 x 10 camera, for by stopping to f. 32 an 8 x 10 plate will be covered sharply to the edge.

36. **Complete Equipment for Advanced Commercial Work.**—The photographer who wishes to equip himself for all classes of commercial work will require the following outfit:

37. One 11 x 14 or 16 x 20 view camera, the size depending upon the requirements made upon the photographer in the particular district in which he is located.

38. The camera should be fitted with a rapid convertible lens and shutter, and at least two double plate-holders should be included in this outfit. A 6 to 8-foot heavy tripod will be necessary.

39. The above apparatus is for use on special occasions, and for special work, such as flashlight work for large banquets, theatrical work, large groups outdoors, college work, etc., railroad work and large construction work.

40. In connection with the above, a set of smokeless flashlight bags (at least six in number) should be provided. If much work is to be made on 11 x 14 plates, an extra 11 x 14 camera should be added to the outfit.

41. For the moderate size work, one should be provided with an 8 x 10 long, square bellows view camera, fitted with a good rapid convertible lens and good shutter, including a four-times color-screen to fit over the lens; also an extra wide-angle lens, 8 x 10, to be used for interior work, etc., a good rigid tripod, with an extra tilting tripod top, and a tripod stay for holding the legs of the tripod from slipping on smooth surfaces; and at least a dozen plate-holders should be included. Also, a 5 x 7 Reflex camera, to be used for speed work and at-home portraiture.

This camera should be fitted for use with plate-holders or roll-holder attachment for films, or in place of the roll-holder a film pack will be found very convenient.

42. A magnesium blow flash-lamp will be required for the photographing of castings, machinery and interiors, and one should also be provided with an ordinary flash-lamp for flash-powder use.

43. In providing cameras with lenses, where the anastigmat type of lens is procured, an 11 x 14 anastigmat lens can be successfully used for 16 x 20 wide-angle work, by stopping down to f. 22, and an 8 x 10 anastigmat can be made suitable for work on 11 x 14, by stopping to f. 32, and a 5 x 7 anastigmat can be used on an 8 x 10 stopped to f. 32. By selecting this class of lens you have at hand a wide-angle lens for use on any of your larger cameras.

44. It is advisable to have a four-times color-screen to fit over any of the lenses, for by means of the screen some extraordinary improvements can be produced over the use of the lens alone.

45. **Plates.**—Various speeds and kinds of plates will be required for various classes of commercial work, but where an all-around plate is desired, the exact nature of the lighting conditions for the subject you are to photograph not being known, the more rapid brands should be employed, for with them it is possible to obtain a sufficient amount of exposure, at least, while if a very slow plate were used it might be difficult—or perhaps impossible—to make a negative at all. Where the objects to be photographed remain stationary, the length of the exposure, so far as the moving of the object itself is concerned, does not have to be taken into consideration, and a slow plate should be used, for with it there is greater latitude and the results are invariably clearer and contain more contrast. If a sufficient amount of exposure be given, and the subject has been properly lighted, no difficulty will be experienced in securing the proper amount of detail in the shadows, and by careful development the high-lights will, practically speaking, take care of themselves.

46. The fastest brands of plates are especially suited for all extremely short exposures and flashlight work. Whenever it is necessary to work in changeable and uncertain light, and especially in the winter, when under-exposures are frequent, fast plates should be used.

47. For the copying of drawings, manuscript, plans and printed matter, and in all cases where black and white effects are desired, the slowest plate obtainable should be employed. These plates generally require ten to fifteen times longer exposure than the rapid plates.

48. Slow plates should be employed for the reproduction of the grain of wood in mahogany furniture, dark oak, bird's-eye maple, etc. Slow orthochromatic plates have considerable latitude, but lack, to a certain extent, the strong density in the middle tones, which is important in work belonging to this class. Flower and landscape photography require the use of the special orthochromatic plate, in order that the correct rendering of color values be given. The brilliant coloring of the foliage is much more dull, black and lifeless when the ordinary plate is used. In fact, for general all-around work in which the correct rendering of color is desired, the orthochromatic plate should be employed.

49. The non-halation plates will be found useful for many kinds of subjects, and especially are they valuable in photographing interiors when strong lights or out-of-door openings are included in the view, which always reproduce very dense and with considerable halation at the edges. When photographing shops containing machinery, rooms with furniture, or any highly polished articles, there is always danger of strong reflections, which will cause halation, and for these a non-halation plate may be used to advantage. Very soft detail in the high-lights under most trying conditions can be secured with them. The slight additional cost of non-halation plates over the ordinary plates will be outweighed by their advantages.

50. The non-halation plate does not, however, do away with halation in extreme cases, and there are other

methods which may be employed in conjunction with the ordinary plate, whereby halation may be practically eliminated from the most difficult views possible to photograph. (See Illustration No. 52a, Page 142, and Illustration No. 53a, Page 146.) In the chapter on *Special Development*, Volume II, is given full information as to the manner of producing excellent negatives of subjects photographed under the most difficult and trying light conditions, with the total absence of halation in the final results.

Chapter III.

The Reason for Orthochromatism.

51. It is often difficult for the uninitiated to understand and appreciate the principles involved in correct rendering of colors in monochrome (one color). Messrs. Wratten and Wainwright, Ltd., of Croyden, England, in their booklet "Real Orthochromatism," give a very clear explanation of the subject, and the following is, in substance, taken from a portion of the article:

52. To make the principle most clear, one should be in possession of a small piece of dark blue and one of dark green (not green-yellow) glass, celluloid, or gelatin. (The glass may be procured from a dealer in stained glass.) If the blue glass is held up in front of one eye and any scene observed through it, it will be noticed, in the first place, that the screen has removed all color from the scene—that in fact all things are one color, namely, blue. But if you consider the scene a little longer, you will see that not only have all things lost their color, but that different colors have lost brightness to different extents, and the relative brightnesses of the scene are *wrong*. The bright yellows, reds, and yellow-greens have become dark, while the usually dark blues and violets have become light.

53. Now, if you photograph the scene on an ordinary plate, and then compare a print from the negative with the scene as it looks through your blue glass, you will see that the plate gives exactly the same incorrect rendering; that it sees bright yellows and reds dark, and dark blues and violets bright. And if it is a landscape with blue sky and light clouds, you will find that the screen and the plate agree in making those clouds invisible. Now it is in order that you may get those yellows and blues of the same degree

of brightness as the eye sees them that you are so frequently advised to use orthochromatic plates and screens.

54. You have probably been convinced that it is desirable to avoid this objectionable sensitiveness of a plate to blue and insensitiveness to all the other colors, and you have decided to try what is known as orthochromatic or isochromatic plates—that is, plates which are sensitive to other colors than blue. But there are difficulties. In the first place, it is not yet practicable to make plates which are not very much more sensitive to blue than to other colors (and your eye is very much *less* sensitive to blue than to other colors), so that you must put in front of your lens a piece of yellow glass or gelatin, which will stop the blue light before it gets to the plate. This yellow screen must increase the exposure the plate will need. If it does its work properly, it will increase the exposure very much. Most orthochromatic plates are about twenty times as sensitive to blue as to green, so that if this matter is to be put right, the screen which cuts out the blue light will require about twenty times the usual exposure for the plate.

55. Also, you are accustomed to developing plates by a red light, so that the plates you use must not be sensitive to red. *This means that the plate will still be blind to red.* If you hold a green glass in front of your eye, you will see how things look to a plate which is sensitive to green, and is being used with a yellow screen strong enough to cut out the excess of blue light, but is not sensitive to red. You will see at once that the reds are not right; they are still black. In fact, to call the plate orthochromatic was wrong, because “orthochromatic” infers that correct color rendering is obtained, and no red-blind plate can give that. So that for *real orthochromatism* you must use a red sensitive plate, and that means that you cannot develop in red light. We will go back to that presently.

56. But you are probably a photographer who photographs landscapes mainly, and there are not many reds in landscapes. Take two pieces of colored fabric, a bright green and a yellow, and look at them through your green screen.

You will see at once that compared with the yellow the green has become too light. The cause of this needs a little explanation.

57. An object is yellow because it absorbs the blue from white light, and does not reflect it, so that all the rest of white light, except blue, is what we call yellow; that is to say, yellow is white light minus blue. Gas light, for instance, is yellow because it does not contain as much blue as the daylight with which it is compared. White light contains red and green and blue, so that if we take away blue from white light, we get only red and green light left; that is, red light and green light together make yellow light. An object is yellow because it reflects the red and the green portions of white light, but not the blue portion; therefore, a red-blind plate will not see the red in yellow, but only the green, and consequently it will see a bright green object as too light compared with a yellow object, just as you see it through the green screen.

58. If a red-sensitive plate is used, then it records not only the green in yellows, but also the red, and consequently yellows do not appear the same as green—they are lighter. Thus one of our difficulties has been overcome entirely by using a plate sensitive to all colors, or panchromatic. The other difficulty with regard to exposure is removed by the same procedure.

59. The only satisfactory method of obtaining a fast red sensitive plate is to bathe the plate in a solution of dye. Ordinary orthochromatic plates are sensitized in the course of manufacture by adding a dye to the emulsion, but this has not yet proven satisfactory, and the "Panchromatic" or "Trichromatic" plate owes its success to the fact that it is sensitized by bathing. In this plate the sensitiveness to other colors than blue is so great that a screen increasing exposure only three times gives superior results to one requiring twenty times increase on green-sensitive or "red-blind" plates.

60. **Orthochromatic Screens.**—You will sometimes see it stated that you can use some particular "orthochromatic"

plate without a screen. You can, but you will *not* get any appreciable orthochromatic effect.

61. A color-sensitive plate will do everything that an ordinary plate will do, so that the photographer who uses panchromatic plates exclusively is at no disadvantage as compared with the photographer who uses ordinary plates, but at a great advantage; for even without using any screen he may get some improvement in rendering, while with a screen his work will always be superior in this respect.

62. If the very color-sensitive panchromatic plate is used without a screen, it will give you about the same result as if you use the old orthochromatic plate with a four-times screen; consequently, whenever possible, you should use a screen.

63. Possibly you have used orthochromatic plates before, and have one or more screens. Naturally, you want to know whether you can save getting new screens by using those you already have. Examine them carefully, and you can easily ascertain this. If they consist of brownish-yellow glass, they are practically useless, will require great increase of exposure, and should not be employed. If they are light lemon-yellow they may be useful.

64. The four-times screen supplied by Burke & James, or the dry-plate and lens manufacturers, are suitable for general purposes for use with orthochromatic, trichromatic or panchromatic plates, and may be considered a standard all-around screen.

65. With a four-times screen on the regular orthochromatic plate you correct the blues, greens and light yellows with distinguishable results—that is, you bring all colors nearer their relative visual tone and produce contrasts, while with the same screen on a panchromatic or trichromatic plate you, in addition to the former corrections, correct the violet and red colors also, thus giving a true rendering of all colors in monochrome.

66. The color-screen should never be used on an ordinary plate, for it would require an enormously long ex-

posure, and experience has taught us that it is of little value, over the ordinary exposing of the plate, without a screen; while with the orthochromatic plates, which are corrected for use with the screen, the exposure is but slightly increased over the ordinary plate without the screen. Thus it will be readily seen that the screen should only be used with orthochromatic plates.

67. For copying of colored objects, such as oil paintings, lithographs, etc., a fifteen-times screen will assist in producing better results, but for all ordinary purposes the four-times screen is recommended.

CHAPTER IV.

Commercial Exterior Architectural Photography.

68. **Introduction.**—The principles embodied in commercial photography out-of-doors are exactly the same as those on which instruction was given in Volume III, but the commercial features are entirely technical, the artistic side demanding very little consideration. It is quite true, however, that the laws of balance and light and shade should be borne in mind, and the subject composed and lighted so as to produce the best general effect. In this chapter are supplied numerous illustrations showing different conditions under which the photographs were made. These illustrations should serve to materially assist the student in the photographing of this class of subjects.

69. **Residences.**—In photographing residences it is absolutely essential that all of the strong points of the architecture be shown. Frequently trees and shrubbery will interfere, making it difficult to show the building properly. In such a case, if it is possible, the photograph should be made at a season of the year when the leaves are off the trees. An example of a residence photographed under these conditions is shown in Illustration No. 2. With the trees in full foliage it was absolutely impossible to secure a picture of this residence, unless an extremely wide-angle lens was employed, and even then the smaller trees occupied undesirable positions, necessitating a point of view to be chosen which would not show the building to its best advantage. Although some of the finer qualities have been lost in the half-tone reproduction, you will notice that there is full detail in the highest points of light, as well as in the deepest shadows.

70. The angle at which the light falls and the portion

of the building receiving the strongest light are extremely important factors to be taken into consideration. There are times when it is advisable to photograph a building on a cloudy day, when there is a soft, delicate light. Then again, not only more pleasing, but far better technical results will be secured when the light is really bright—in fact, when the sun shines and casts quite heavy shadows. Shadows falling horizontally, or quite nearly so, tend to exaggerate the breadth of a structure. The height, on the other hand, will be exaggerated when the shadows fall perpendicularly. Shadows falling diagonally on the building will produce various effects, much depending upon the lines of the building itself.

71. The residence shown in Illustration No. 2 was photographed quite late in the afternoon, as will be seen by the direction in which the shadows fall. This time of day was chosen because it was desired not to exaggerate the height of the residence. This lighting gives a most truthful rendering of this particular structure. The point of view from which the exposure was made was such as to show the principal features of the architecture. If taken so as to show the opposite side of the house, the result would not have been so pleasing, as that side is quite plain and has an objectionable chimney on the outside of the wall, which, with its parallel lines running from the ground to the top, was undesirable.

72. Notice that the small tree trunk, which is almost in the center of the foreground, and just outside of the walk, does not hide the corner of the bay-window. If the camera had been placed but a very few inches to the right, this tree would have hidden the corner line of the building, and thus have destroyed a feature of the architecture. In the position it occupies, the tree is not at all objectionable.

73. An important consideration, when making photographs of residences, is to see that the shades on the windows are properly adjusted. As a rule, the shades should be raised half-way, so that their lower edge will come directly opposite the middle sashes. To have the shades



Illustration No. 2
Residence
See Paragraph 69

Photo by T. E. Dillon



Photo by T. E. Dillon

Illustration No. 3
Residence
See Paragraph 75

drawn at different lengths mars the general appearance of the house. The lace curtains on the window should be arranged to hang gracefully. In fact, everything should appear just as natural as possible.

74. When it is desired to photograph a residence to show its architectural construction only, it is advisable to secure the picture as soon after the residence is completed as possible, for then there will be few, if any, trees to obstruct the view. The lawn and surroundings, however, should be cleared and made to look as neat and tidy as possible; for, if boxes, trestles, planks, and other objectionable objects occupy a position in the foreground, they will detract from the building to such an extent as to render the photograph entirely undesirable and of little or no value for the purpose intended. Anything which will detract from the residence itself should be removed, if possible. If this cannot be done, a time of day should be chosen when the objectionable feature will be in shadow and, therefore, attracts little attention.

75. Two residences of almost identical architectural design are shown in Illustrations 3 and 4. The one, however, is of wood, painted white, while the other (Illustration No. 4) is of cream colored brick, and it was, therefore, necessary to have a different lighting for each.

76. When photographing the residence shown in Illustration No. 3, which is built on quite an elevation, a low view-point was necessary in order to show the strongest features of the architectural design and include the general surroundings. Had this picture been made under a clouded sky, the building would have appeared flat, as well as broad and squatty. A time of day was, therefore, chosen when the sun was quite high; thus the cornice and trimmings cast long perpendicular shadows on the building, which gave the impression of more height. If the sun had been low the shadows would have been cast horizontally, causing the building to be exaggerated in width and appear quite squatty.

77. Another reason for making the exposure at the

particular time of day it was made was to have the strongest light on the front, in order to produce relief in the capitals of the pillars and the ornaments at the corners of the residence.

78. In Illustration No. 4, a time of day was chosen when a portion of the front of the residence was in shadow, yet the sun shone on the pillars of the porch in such a way as to give an immense amount of relief. This lighting effect verges onto the artistic, and is a very pleasing one for this particular subject. It would have been difficult to have secured the effect of atmosphere or distance if the front, as well as the side, had been strongly illuminated with direct sunlight.

79. The picture is a most truthful rendering of the subject. The point of view chosen is practically the only desirable one, for by moving to either right or left a tree would have cut into the building, while as it is, the only portion that is hidden is the upper right-hand corner, which is behind the lower branches of the tree. This is not objectionable, as the corner of the residence nearest the camera gives a clear idea of the architectural construction. If, however, it had been desired to show both corners, a closer view could have been made, by means of which the trees would have been avoided; but, of course, less foreground would have been admitted, and while from a commercial standpoint the architectural effects would be reproduced, yet the general balance to the picture, to make it appear more pleasing to the eye, and a truthful representation of the property, requires more of the general surroundings.

80. An entirely different type of architecture is shown in Illustration No. 5. Notice the lighting effect, and also the point of view. This building, although quite tall—much taller than is apparent in this illustration—appears to be very broad, owing to the fact that the shadows are cast in a horizontal direction, the sun being very low. A more pleasing view, and one which would have shown less of the round roof of the veranda, would have been from the opposite corner. The long horizontal line of the eaves,



Illustration No. 4
Residence
See Paragraph 75

Photo by T. E. Dillon



Photo by T. E. Dillon

Illustration No. 5
Residence
See Paragraph 80



Illustration No. 6
Residence—English Architecture
See Paragraph 82

Photo by T. E. Dillon



Illustration No. 7
Country Residence
See Paragraph 84

Photo by T. E. Dillon

which runs from one corner of the building to the other, is very objectionable, and especially so as this line is parallel with the ridge of the roof immediately above.

81. If the picture had been taken from the other corner the same proportion of the two chimneys would not have existed. In fact, the chimney to the right would have been almost wholly obstructed from view by the roof. The other chimney, being on the outside of the building, would have assisted in giving height to the structure, and its perpendicular lines would have very materially helped to counteract the long horizontal lines of the veranda roof. The lines of the left-hand chimney do not run parallel from the roof to the ground, as the lower third of the chimney is much broader than the upper portion.

82. In Illustration No. 6 we have still another type, known as English architecture. An excellent view-point has been selected for photographing this residence, in that it shows all of the strong points of its construction. This view is an exceptionally valuable one for the architect who wishes detailed information regarding the form of construction. A front view of the house would have been objectionable, as it would have been too tall for its width to give a pleasing proportion. If a photograph had been made from the opposite corner, but little idea would have been given regarding the form of architecture other than that shown in the front gables.

83. There are times when it is impossible, perhaps owing to location, to secure a point of view for photographing residences that is at all pleasing, and it is therefore necessary to select the best one possible under the circumstances.

84. In Illustration No. 7 we have a reproduction from a photograph made under conditions which are quite common. This structure is built on quite an elevation, and under ordinary conditions is an extremely difficult subject. The building, as you will observe, is large and square, but not high in proportion to its width. By covering the end wing of the building to the right with a sheet of blank

paper, you have a well-proportioned building as to height. By covering the small wing to the left, you have a more massive appearing building. If this building, as it stands, were viewed from an elevated point, it would appear still more beautiful as a work of architecture, but in working from an elevation you would not have the natural view-point of the building, as the elevation on which the residence is built would appear more level; therefore, in order to reproduce the residence and its surroundings, and give a truthful rendering of its appearance as it rests on this elevation, the picture is taken from a point of view which shows that the residence is situated on the top of a knoll, and not on level ground. The best results would have been secured if the photograph could have been made from a slightly elevated position.

85. **Exposure.**—Again referring to the six photographs of residences, you will observe that a sufficient amount of exposure was given to secure a full amount of detail even in the very deepest shadows, and in doing this it was not necessary to sacrifice the quality of the high-lights, which, also, are full of detail and do not appear at all chalky or blocked. The secret of good negatives, therefore, lies in full exposure and proper development. In fact, an architectural negative should by no means be over-developed, as the high-lights will immediately become hard and will not produce the best of results in the finished print.

86. **Public Buildings.**—Although the general principles in the photographing of public buildings are approximately the same as for residences, there are some special features which need consideration. As a general rule, it is somewhat difficult to get far enough away from the subject to use a narrow-angle lens and secure all of the object on the plate. Especially is this true in large cities, where the buildings are tall and the streets too narrow to permit one to secure the proper view-point and include all of the building within the picture space. There are various ways of overcoming this difficulty; one is to use a wide-angle lens, but this is not always satisfactory, as it tends to give distortion and



Illustration No. 8
School House
See Paragraph 88

Photo by T. E. Dillon



Photo by T. E. Dillon

Illustration No. 9
Court House
See Paragraph 90

does not reproduce the building truthfully as the eye sees it.

87. Then, again, when photographing so near the building, especially if it be a tall one, the camera will have to be pointed upward, and if not provided with a swing-back, rising and falling lens board, or a swing-bed, the lines of the building will not be true. Even with these attachments to your camera the lens employed may not allow of all the building being admitted on the plate. The best method in such cases is to ascend to the second or third floor of some building opposite the one you are photographing, and from the window make the exposure. The height from which you take the picture will depend upon the height of the building being photographed. It is advisable to have the camera opposite the center of your object; then you will be able to secure the proper amount of foreground, as well as a sufficient amount of space above the building.

88. Not only is difficulty experienced from having to work in crowded quarters, but many times telephone poles, trees, fences, and other objectionable features are to be contended with. In Illustration No. 8 is reproduced the picture of a school-house. This was a comparatively simple subject, yet there was practically only one point of view from which it was possible to make an exposure. Even from this point the flag-pole in the foreground, which stands out white against the dark roof, is objectionable; yet in order to show the building to its best advantage, a view-point was selected admitting the pole where it would appear the least conspicuous, and yet enable one to obtain a good view of the building. It would have been possible to make a straight front view of the building, omitting the pole, but this would not give good lines to the building. It may be taken, as a general rule, that a front view of a building which is situated by itself is objectionable. It is, however, advisable to show more of the front than the side, and the strongest light should fall on that part of the building nearest the camera.

89. As all public buildings usually are erected in the

center of a large square plot of ground, they may be quite easily photographed. Where there are many trees to contend with, late in the fall of the year will be the best time to make the photograph, for then the leaves will be off the trees, permitting of a full view of the building being secured.

90. In Illustration No. 9 we present a picture of a court-house, built of stone, located in the center of a square. The stone and trimmings being of practically one dull color, the structure required bright sunlight to illuminate the projections so as to cast shadows upon the plain surfaces, and thereby supply contrast and snap. It is important that the sunlight should fall on the building at the proper angle.

91. In making the picture for Illustration No. 9, the front of the building facing the west received no sunlight until quite late in the afternoon; consequently the picture was made at this time. If a later hour in the day had been chosen the sun would have broadly illuminated the front of the building, and the effect would have been extremely flat as compared to what is shown in Illustration No. 9. This demonstrates another principle in architectural photography: Relief and a true sense of distance or atmosphere are essential, and the light should fall at an angle on that side of the building facing the camera to secure this effect. Observe that a sufficient amount of exposure was given to secure full detail even in the deepest shadows. The development was carried only far enough to give strength and brilliancy, and yet retain the detail in the high-lights and the actual quality of the stone.

92. A subject quite apart from those we have previously treated is shown in Illustration No. 10, which is a strictly commercial view of a bank building. Such a picture is required when the building is situated in a business block. A front view should be made to avoid distortion. The same principle of relief must be adhered to; in fact, it is absolutely necessary that the angle at which the light falls be such as to give perfect relief in every respect. A straight front or flat light will give a picture which will

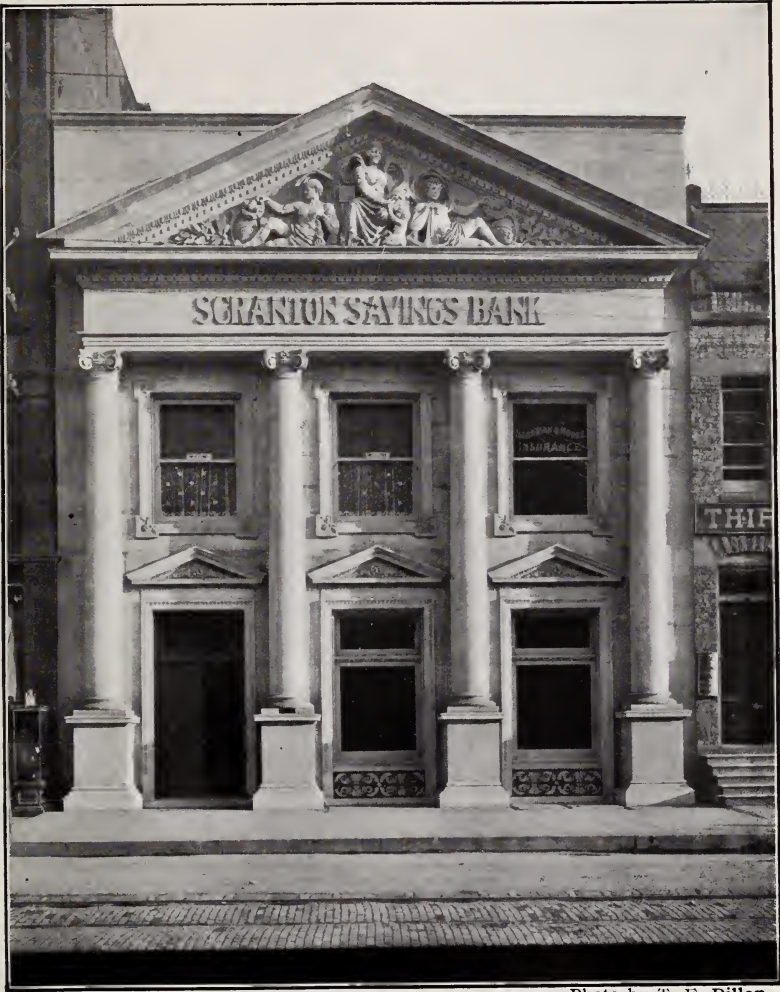


Photo by T. E. Dillon

Illustration No. 10
Bank Building
See Paragraph 92



Photo by T. E. Dillon

Illustration No. 11
Architectural Detail
See Paragraph 94

be totally valueless. Where there is carving, ornaments and lettering, such as shown in the accompanying illustration, the light should fall at an angle of about 45° , thus permitting the letters and figures to cast a shadow which will make them stand out in perfect relief. The exposure and development must receive the same careful consideration as given all other architectural subjects.

93. **Sectional Detail.**—It is many times desirable to show certain portions or features of a residence or other building, such as gables, doors, windows, porches, pillars and their capitals, as well as various ornaments and carvings. In a later chapter architectural detail will be treated upon fully.

94. In Illustration No. 11 is shown the entrance to a library. The object of taking this particular view was to show the entrance, also the gable construction. Notice that this view was made when the sun was shining brightly, thus casting heavy shadows, falling at an angle of about 45° . The proper exposure, however, was given and the plate correctly developed so that there is detail in both shadows and high-lights. The shadows are not flat and lifeless, nor are the high-lights hard and chalky.

95. **Practice Work—Exterior Architectural Photography.**—It is almost impossible to give any definite advice regarding the selection of the subject. Generally speaking, however, one should always take a general view of the scene which is to be photographed, and not hurry to make an exposure before being absolutely certain that the best point of view and best light conditions have been chosen.

96. When photographing residences there are many things to take into consideration: In the first place, consider the purpose or use of the picture. Is it to be used as an artistic architectural view, or is it to be used for detail construction work, or to show the building with general surroundings, giving a truthful representation of the building and its location? The purpose for which the picture is intended has much to do with the selection of the viewpoint. In all cases consider any obstructions, such as

trees, telephone poles, fences, etc., which may be in front of the building to be photographed. Try to avoid these as much as possible. Study the building itself and see which side shows the strongest architectural features and presents the most pleasing general outline with the least number of long parallel lines coming into prominence.

97. When possible you should study the lighting effect on the building at various times of the day, and ascertain what time of day is best at which to make the exposure. Bear in mind that long perpendicular shadows on the building tend to exaggerate the height while horizontal shadows exaggerate the breadth. When necessary to produce harsh effects or increase the contrast, a bright, sunshiny day should be chosen. When softness is necessary, and you desire to flatten the appearance of the subject to a certain extent, a cloudy or dull day should be chosen in which to make the exposure. Under no circumstances, however, should you have a flat result. Relief and roundness are extremely essential features, and the light should fall (in the majority of cases at least) so as to more strongly illuminate the portion of the residence or building nearest the camera.

98. **Accentuating Shadows on Dull Days.**—Where residences are photographed under a clouded sky the color values—lights and shades—may be accentuated considerably by stopping down the lens. For example, if you are using a stop U. S. 8, then to stop down to U. S. 16, giving practically the same exposure or at the most only a trifle more than you would to fully time a plate with stop U. S. 8, you will find this will accentuate your shadows, and you will also have a crisp and snappy negative, with sufficient exposure for the high-lights, providing development has been properly carried out in a normal bath.

99. The examples shown in the preceding lesson will give an excellent idea of the proper form of light. There is nearly always a certain time of day which will give the most pleasing rendering. Fortunately, in architectural photography the distracting color factor is, to a large extent,

absent, which makes the work much easier, and enables one to see the monochrome effect more clearly.

100. In selecting the view-point, a very common error, with beginners at least, is that of selecting a direct front view. This is a mistake, for in photographing residences, especially, a straight front view is not a pleasing one, and such a view should only be selected when it is absolutely impossible to photograph from any other point. A perspective view showing the front and one side of the residence is always the best.

101. The distance at which the camera should be placed to one side of the center of the front depends entirely upon circumstances. Care should be taken to always include a fair amount of foreground, and if any large trees come within the field of view it is advisable to have some foreground between the tree base and the camera. It will not do to have the top of a tree included within the picture space and then cut off its base, without giving it any support within the picture space.

102. If there are any special features or points of interest in the architecture which are stronger than others, these dominating points of interest should be emphasized by photographing them when the sun shines on them at the proper angle.

103. It may be taken as a general rule for exterior work, that subdued sunlight falling on the building at an angle of 45° will be found to give the best results, unless some special effect is sought, in which case you must be governed entirely by the effects desired.

104. **Leveling the Camera.**—It is essential that the camera be perfectly level, and as the majority of view cameras are fitted with a plumb or a spirit level, it is an easy matter to see that the camera is upright in both directions. A pocket level will be found exceedingly convenient, for it can be placed on any part of the camera. With the camera leveled, then set the thumb-screw tight, holding the camera rigid to the tripod.

105. Where lenses of good covering power are em-

ployed, it is best to level the camera immediately after securing the general view on the ground-glass, and then to rely entirely upon the movements of the rising or falling front to include the extent of the view required. If, however, the camera is tilted up and the use of the swing-back resorted to, the lens will have to be stopped down to obtain the required sharpness, for the image will be more indistinct at the bottom of the plate than at the top. This decreases the working rapidity of the lens—requiring longer exposure.

106. **Stop to Use.**—The size of stop to use will depend entirely upon the covering power of the lens employed. The whole plate must be cut with good definition to the extreme edges, and the depth of focus must include all of the principle parts of the building. For commercial work, where good clear definition is the great essential, more stopping down is required than for portrait work. It is a good practice to always use a one size smaller stop than is necessary to secure a good general focus. This extra stopping down will have a tendency to accentuate shadows and give crisper negatives.

107. **Exposure.**—A light colored building will require much less exposure than a dark one, while the exposure on a slightly dull day will not be appreciably greater than that required on a bright sunny day. Usually, for exterior architectural work on a bright day, with a stop at *f. 16* or *U. S. 16* (which is the usual stop used for this class of work) a bulb exposure—pressing and releasing the bulb, which requires approximately a half-second exposure—is sufficient; for a cloudy day double the exposure, or one second, would be about right.

108. It is impossible to give any definite information regarding the exact amount of exposure. The general rule, however, is to give sufficient exposure to secure full detail in the deepest shadows.

109. **Development.**—As a rule, exterior architectural views can be treated as average outdoor subjects, and a developer of normal strength used. The formula for the

Commercial Exterior Architectural Photography. 61

Universal Developer, as given in Volume II, is recommended. So many architectural photographs are seen, wherein the high-lights are hard and chalky. This is due to the use of too strong a developer and the carrying of development too far.

110. Proof-prints should be made from experimental negatives, and full data, including color of building, time of day, light conditions, size of stop, amount of exposure, and any other features of importance, placed on the back, and the proofs filed for reference.

CHAPTER V.

Part I.

Extreme Wide-Angle Photography

By Means of the

Goerz Anastigmat Hypergon Lens.

111. While the wide-angle lens is at no time the lens which will give the most perfect representation of a building, scene or object, its use is often compulsory, especially in cramped positions or narrow quarters.

112. **The Hypergon Lens.**—The shorter the focal-length of a lens, in proportion to the size of plate it is intended to cover, the greater the angle it cuts; in other words, the nearer it can be brought to the object to be photographed, and still retain absolute sharpness on the plate, the greater is the angle. The ordinary inexpensive wide-angle lens has an angle of from 75 to 90 degrees; anastigmat wide-angle lenses are made to cover an extreme angle of 110 degrees. Even at this angle, certain subjects come into the commercial man's sphere, which cannot be brought on to the plate, owing to extreme height, or unusually narrow quarters. To cover these extreme instances, the Hypergon lens was put on the market by the C. P. Goerz Company. This lens differs in construction from any other form of wide-angle lens, and is so calculated that it will cut the enormous angle of 135 degrees. What this means can be realized when one remembers that a full arc only measures 180 degrees. (See Illustration No. 13.)

113. **Size Plate Covered.**—The diameter of the image circle—in other words, the diagonal of the plate covered by the Hypergon double anastigmat—is equal to five times

its focal-length. This means that a Hypergon of 6-inch focal-length will cover a plate of 20 x 24 inches, thus fully covering four times as great an area as a 6-inch lens of the old construction. The peculiar construction of the lens, which consists of two semi-spherical single lenses, is such that the light falls off very rapidly toward the margins of the image. This is unavoidable in all forms of wide-angle lenses, but becomes more noticeable the greater the angle of the lens.

114. **The Star-Diaphragm.**—To overcome this, the Hypergon is supplied with a rotating star-diaphragm, which is so delicately adjusted over the optical center of the lens that a pressure of air from a bulb attached to a small blow-pipe, fixed on the mounting of the lens, starts it rotating. In this way the light is held back over the center of the picture during a part of the exposure. The diaphragm is then dropped by pressing a spring and the balance of the necessary exposure given. The plate is in this way given even illumination all over. A regular leather cap is supplied to cover the lens before and after exposure.

115. Under certain favorable light conditions the Hypergon can be used at a speed of 1-35 of a second. For this purpose a special form of shutter is supplied, similar to the old drop-shutter, but arranged with its opening so that a greater amount of light reaches the margin of the lens than the center, thus equalizing the exposure. Usually, however, the small stop is employed, using the rotating diaphragm, and an exposure of from 3 to 15 seconds given.

116. **Working Aperture.**—The maximum relative working aperture of this lens is f. 22 (U. S. 30.25). It has all the regular corrections of the anastigmat lens, except for chromatic aberration, but this is eliminated *after* the image is focused, by the use of the smaller diaphragm opening.

117. The demonstration shown in Illustration No. 12 clearly shows the immense covering power of the Hypergon lens. The upper print in this illustration was made with a Goerz Celor No. 3 lens ($8\frac{1}{4}$ inches focal-length), the exposure being 1-25th second; while the lower one was made



Illustration No. 12
 Goerz Hypergon Lens Demonstration
 See Paragraph 117

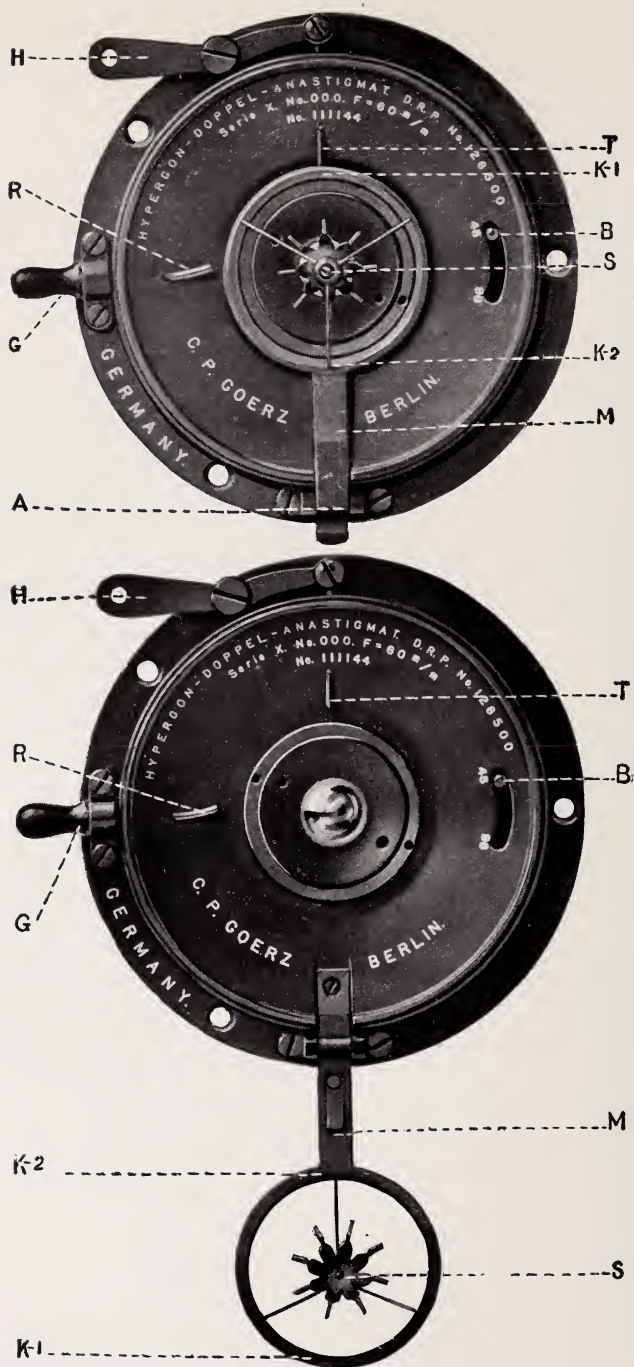


Illustration No. 13
Goerz Hypergon Lens
See Paragraph 112

with a Goerz Double Anastigmat Hypergon lens (No. 000-2 $\frac{3}{8}$ inches focal-length), requiring 4 seconds exposure. The camera in both cases was in identically the same position.

118. It will be observed that there is absolutely no distortion in the wide-angle view, each and every line being perfectly accurate. Some persons may contend that there is distortion of perspective, or rather an unnatural perspective shown, but it must be borne in mind that the field of the lens being so great this is unavoidable. On the other hand, if, when looking at the wide-angle view, the eyes are held at a distance from the print equal to the focal-length of the lens, this apparently exaggerated perspective is entirely done away with and the actual normal perspective seen.

119. **Streets and Interiors.**—The most practical application of this wide-angle lens, to the commercial photographer at least, is in photographing very high buildings located along narrow streets, and general interior views. Illustrations Nos. 14 and 15, which show respectively Park Row building and a building on Broadway, N. Y., further demonstrate the advantages and possibilities of the Hypergon Wide-Angle lens.

120. **The Camera.**—The Hypergon lens is most useful in cases of 11 x 14 and larger sizes, owing to its extremely short focal length. When used with smaller plates a special camera will have to be constructed, as the ready built cameras will either not permit of the lens being brought close enough to the plate, or else the various exterior portions, base of camera, etc., will intrude into the picture. Where 11 x 14 and 14 x 17 plates are used, a square bellows view camera or professional camera may be employed, providing the lens can be placed sufficiently close to the plate. In other words, the distance required between the center of the lens and the ground-glass, or sensitive plate, for the No. 0 lens, is 3 $\frac{3}{4}$ inches, and for the No. 1, 6 inches. Although a special camera is procurable through the Goerz people, anyone handy with tools can, in a few minutes, and with little expense, construct a camera box that will answer the purpose as well as the most expensive instrument.

121. **Home-Made Camera Box.**—The following applies to a 5 x 7 size instrument—either larger or smaller ones can be constructed on the same principles: The first requisite is the back of your ordinary camera. On practically all hand and view cameras it is possible to remove the ground-glass spring-back. If this back is reversible it will be perfectly square—*i. e.*, the length of sides and ends are the same. Where the back is not reversible the sides will be longer than the ends. Take the measurements from the inside of the groove or flange of this back (which, if a reversible back, will be $7\frac{1}{2}$ inches) and cut a piece of board to this size, using half-inch lumber.

122. Next, construct a box $2\frac{1}{2}$ to 3 inches deep, omitting the ends, using quarter or half-inch material (the thinner the better), and for a 5 x 7 camera the sides of a cigar box will answer nicely. Care must be taken that the boards are free from cracks or holes, as the camera must be absolutely light-tight. The box should be constructed to fit snugly around the square board you have just cut (which latter is to be the front-board to which the lens is attached). The spring-actuated ground-glass back, which you have taken from your regular 5 x 7 camera, will also fit perfectly in the rear end of the box. Temporarily fasten this in position (it may be tied on with a cord). Now, in the center of the front-board cut a hole to receive the lens. For a 5 x 7 camera the diameter of the opening should be $2\frac{3}{4}$ inches on the front side, while the opening should be beveled so that the inside diameter will be at least $3\frac{1}{4}$ inches.

123. Having the ground-glass back in position in the box, lay it on a table and insert the front-board. Insert a ruler or similar measure in the opening of the front-board and allow the end to rest on the ground-glass, then move the front-board in or out until the front surface of it is the exact focal-length of the lens from the ground-glass. In other words, the distance between the front of the front-board and the ground-glass should be equal to the focal-length of the lens. In the case of the No. 000 lens, this distance is $2\frac{3}{8}$ inches.



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Illustration No. 14

Park Row Building, New York

Made with Goerz Hypergon Lens

See Paragraph 119



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Illustration No. 15

Building on Broadway, New York

Made with Goerz Hypergon Lens

See Paragraph 119

124. Being careful that the front-board is on a perfectly parallel plane to the ground-glass, fasten it in position by inserting small brads in the sides of the box. Now, remove the back, and in order to be sure that all light is excluded insert putty all around the inside edge, between the front-board and the sides of the box; then, paint the whole inside with black paint. A small nut may be procured from a hardware store and this fastened in position in the bottom of the camera, the size of the nut being such as to fit the tripod screw; or a brass nut made to fit the regular tripod screw may be obtained from any camera manufacturer. The back of the camera may be tied on to the box with cord, but it would be far neater to make small brass spring catches to hold the back in position.

125. The outside of the camera can be carefully sand-papered and then either stained or varnished. A water-proof stain will be the best to use. By using a little ingenuity and working with care a very practical instrument can be easily constructed by anyone. Bear in mind that the lens is of universal focus, and that it is not necessary to focus—the distance from the lens to the ground-glass must be equal to the focal-length of the lens.

126. **Making the Exposure.**—The star-diaphragm should be used during three-fourths of the exposure and removed altogether during the latter part of the exposure. The average exposure required for exterior views is from 3 to 6 seconds in ordinary sunlight—using the smallest aperture. When an exposure of 6 seconds is required, the star-diaphragm should be kept in front of the lens for 4 seconds and then removed by lightly pressing down on the release lever, H. (See Illustration No. 13.) As the exposures will be of some length the cap can be used, and no shutter is required. The exact amount of exposure for all work, whether interior or exterior, can be ascertained by figuring out the f value. Bear in mind that the largest aperture of the Hypergon lens is $f. 22$, while the smallest one is $f. 31$, or U. S. 60.

Part II.

Difficulties—Hypergon Lens.

127. **Margins or Corners of Plate Either Transparent or Semi-Transparent.**—Caused by not leaving the star-diaphragm in front of the lens for a sufficient length of time during the exposure. The star-diaphragm should remain in position for at least three-fourths of the time. The lighting conditions and the character of the subject regulate the amount of time to a certain extent. A series of practical demonstrations has shown that the star-diaphragm should remain in front of the lens during thirteen-sixteenths of the exposure. If, on developing the plate, you observe that the corners and edges have not received as much exposure as the center, carry the development beyond the normal for the central portion; in fact, develop until the margins of the image are of proper strength. After fixing the plate, take a weak reducing solution (Red Prussiate of Potash) and locally reduce the central portion of the plate until the whole image is of uniform density. This method of procedure is not to be encouraged, but when one has a negative of a valuable subject and this difficulty occurs, it is advisable to proceed as directed.

128. **Opaque Circular Spots in Center of Plate.**—Caused by over-exposing the center—not leaving the star-diaphragm in position long enough during the exposure to give uniform illumination. To save such a plate, after fixing it reduce the central opaque spot until its density matches that of the surrounding portion.

129. **Opaque Star-Shaped Spot in Center of Plate.**—Caused by the star-diaphragm *not* being revolved during the exposure. Remedy obvious.

130. **Transparent Spots in the Corners of the Sky Portion of the Plate.**—Caused by the hand or finger coming within the angle of view of the lens while making the exposure. As the angle of view is so great, when removing the cap, the hands must be immediately drawn away from the front of the camera. If this precaution is not taken, there will be danger of cutting off rays of light and thus producing transparent spots on the sky portion of the plate.

CHAPTER VI.

Commercial Interiors.

131. **Introduction.**—The photographing of interiors is, by most photographic workers, considered a difficult task and, therefore, has received little attention, except from the few who have specialized on this particular subject. To illustrate this chapter we have chosen a large variety of subjects dealing particularly with all the various conditions of lighting and subject material with which the average photographer will have to contend. The manner in which these different pictures were produced is described at the end of this volume; therefore, we will not dwell upon this feature, but supply numerous suggestions which will very materially assist you to photograph interiors successfully.

132. **Lighting Interiors of Residences.**—In making interior views, generally the question of lighting is the most important consideration. A good rule to follow, at least until you become sufficiently experienced to manipulate the light as required, is to so locate the camera as to have the principal light for the illumination come from one side of, and back of, the camera, and at an angle leading *into* the view—in other words, directed *from* the camera instead of toward it.

133. **Dark Interiors.**—The darker the room and its furnishings, the more direct or broad should be the light employed, while for light interiors and furnishings the more side or cross light should be used. The object of this difference in lighting is as follows: In the case of dark interior furnishings you want to do away as much as possible with heavy shadows, in order to illuminate all portions evenly, and enable you to secure detail in all parts of the room.

134. **Light Interiors.**—In the case of light furnishings, having the light fall upon the subject more from the side will produce slight shadows and give relief and roundness to the various objects. It will not always be possible to have the light enter the room at exactly the angle desired, but as the angle of the light is constantly changing throughout the day there will be times in the day when the light gives better results than at others. For the very best results one should observe the light conditions and make the picture when the light enters at such an angle as to give the most pleasing effects, making the best of the prevailing conditions.

135. **Diffusing Strong Light.**—If the light is extremely bright, as will be the case when the sun is shining strongly, a piece of cheese-cloth, or similar thin material, may be placed over the windows, to diffuse the light evenly throughout the room. This diffusion of the light will supply more even illumination throughout the room, thus permitting of shorter exposure. To over-diffuse will result in flatness. There should be some sparkle and snap to the light, so exercise care that you do not over-diffuse.

136. Observe the very effective lighting of the room shown in Illustration No. 16. All the illumination here comes from the side and in front of the camera, as will be clearly seen, yet even the deepest shadows contain detail, while the high-lights are not at all hard. Owing to the large surface to be covered and in order to have all parts sharp, a small stop was necessary, yet the picture is not at all wiry.

137. **Location of Objects.**—It is seldom advisable to change the location of any of the articles in the room, unless so desired by the person for whom you are making the photograph. All objects in the foreground must, however, come within the angle of view. For example, it would mar the picture materially to have a table or some piece of furniture in the immediate foreground, with the legs cut off, thus removing all suggestion of support.

138. **Height of Camera.**—The camera should be placed at a moderate height, but not too high, for if too high it



Illustration No. 16
Interior—Library
See Paragraph 136

Photo by T. E. Dillon



Photo by T. E. Dillon

Illustration No. 17
Interior—Library
See Paragraph 140



Illustration No. 18
Interior—Library
See Paragraph 140

Photo by T. E. Dillon



Photo by T. E. Dillon

Illustration No. 19
Interior—Bed-room
See Paragraph 141



Illustration No. 20
Interior—Bed-room
See Paragraph 141

Photo by T. E. Dillon



Photo by T. E. Dillon

Illustration No. 21
Interior—Library
See Paragraph 142

will give the floor the appearance of running up-hill. It is seldom, if ever, that perfect conditions exist for the proper illumination of a room for photographic purposes. There is usually some obstacle to overcome and one must utilize the facilities at hand and produce the best results possible. In the following pages we supply numerous illustrations of interiors, all made under different circumstances, but one rule is followed closely, and that is, the light is always leading into the picture—*this is essential*.

139. **Illustrations.**—In Illustration No. 16 observe the general form of composition, or rather the general arrangement of the articles of furniture and the direction in which the camera was pointed. Nothing appears set, nor is the picture space equally divided in any part. You should aim at securing as harmonious a picture as possible, and under no circumstances have a corner of the room divide the picture space into equal parts. Further than this, chandeliers hanging from the ceiling should not occupy a central position. They appear much better located on one side or the other of the center.

140. A reverse lighting effect is shown in Illustrations No. 17 and No. 18. In the one case the light comes from directly back of the camera, while in the other it comes a trifle from the left, as will be easily observed by the direction in which the shadows fall from the legs of the table and chairs.

141. A most beautiful effect has been secured in both Illustrations No. 19 and No. 20. Practically everything in this room was of uniform color, yet there is depth and atmosphere in both of these pictures, and they give a perfect idea of the interior.

142. Illustration No. 21 was illuminated from two windows, one being directly back of the camera, while the other was a trifle to the left. This view was a difficult one to photograph, owing to the fact that the camera could not be located as far back as was desirable and properly admit all the furniture into the view, yet the picture would have appeared much more pleasing if the two chairs in the im-

mediate foreground had been omitted entirely. Although some detail has been lost in the high-lights in the half-tone reproduction, the print, as a whole, is very good from a technical point of view.

143. The lighting for the interior shown in Illustration No. 22 came entirely from back of the camera, which was the only light obtainable for this view. Had it been possible to obtain some light from the side, giving a cross light, better results would have been produced. As it is, however, the picture gives an accurate rendering of the interior.

144. Illustration No. 23 was a very difficult subject to handle, owing to the fact that the whole interior, as well as the furnishing, was very dark and not well illuminated by daylight. It was necessary to burn magnesium ribbon in various portions of the room, behind objects and in doorways which protected the lens from the direct rays of the illuminant. Owing to the extreme length of the hall it was necessary to stop the lens to a very small aperture, and it was left open for a considerable length of time, permitting the photographer to move about within the picture space and burn the ribbon at the various points from which it was desired to throw the light in order to give an even illumination.

145. Illustration No. 24 shows a room illuminated entirely from the skylight in the ceiling. This was a very great advantage for this particular view, and it gives good lighting on the paintings, which would not have been the case if the light came from a side window.

146. Illustration No. 25 shows a general interior of a residence, in which is included the view of two other rooms. This gives an excellent idea of the general plan of this portion of the house, in addition to showing the room in the foreground with its general arrangement of furniture.

147. The picture of the den shown in Illustration No. 26 was illuminated from a window back of the camera. The interior was very dark, yet with a sufficient amount of exposure full detail has been secured.

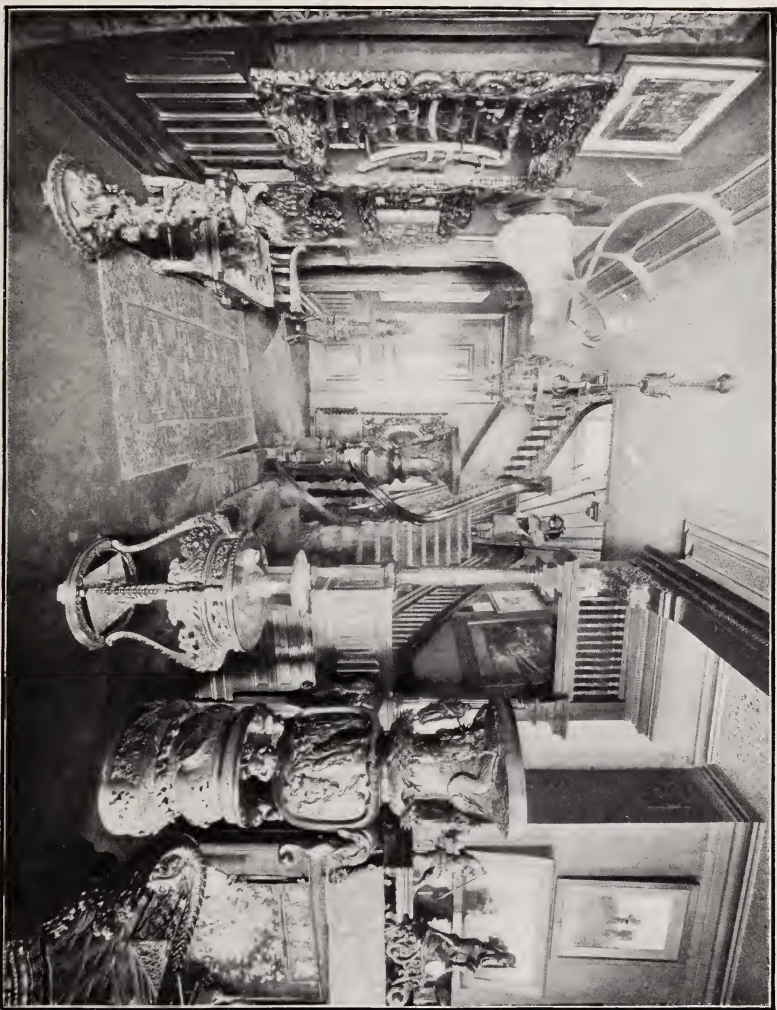


Illustration No. 22
Interior—Reception-hall
See Paragraph 143

Photo by T. E. Dillon

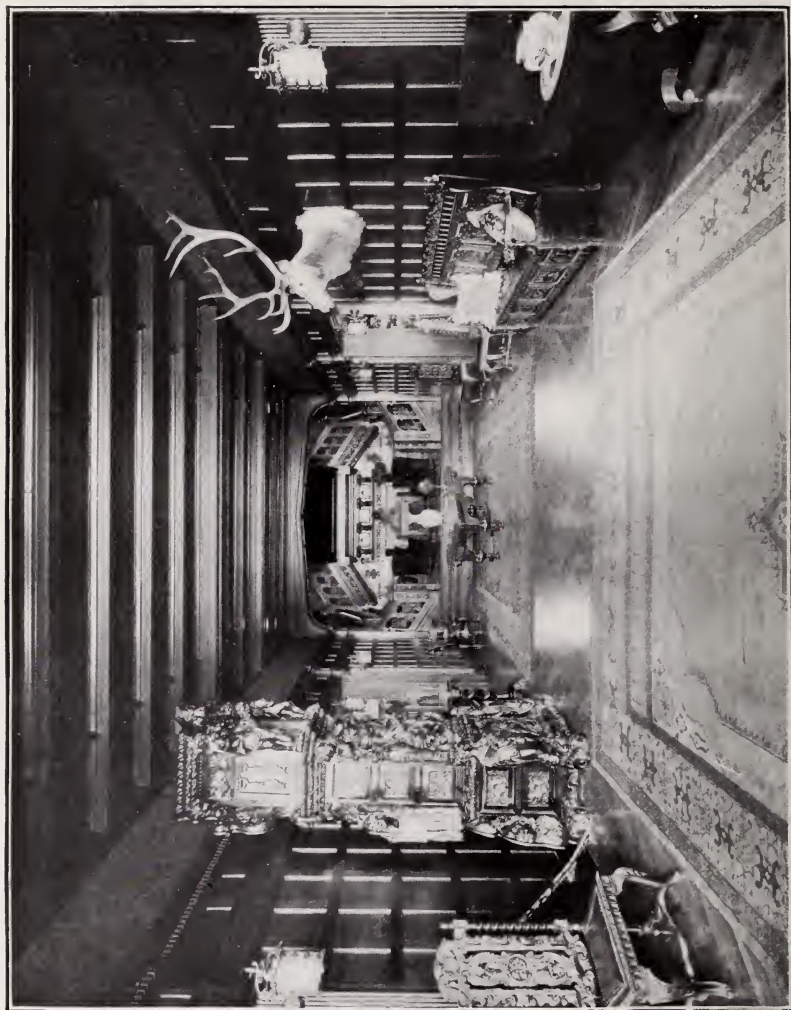


Photo by T. E. Dillon

Illustration No. 23
Interior—Reception-hall
See Paragraph 144

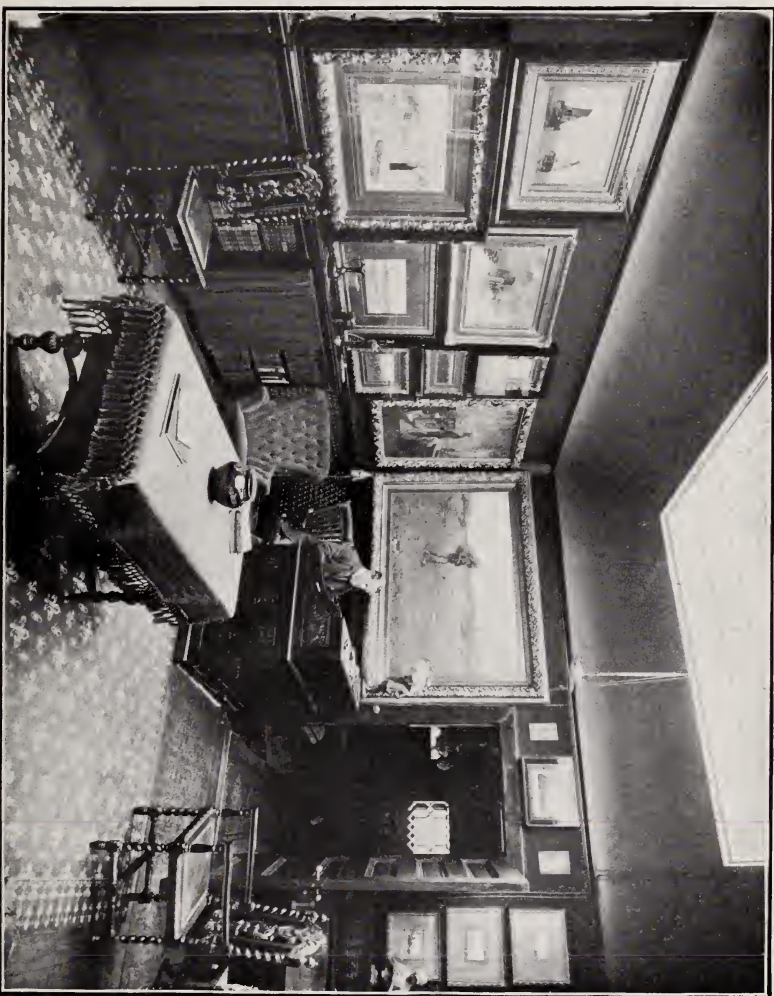


Illustration No. 24
Interior—Library
See Paragraph 145

Photo by T. E. Dillon



Photo by T. E. Dillon

Illustration No. 25
Interior—Living-room
See Paragraph 146



Illustration No. 26
Interior—Den
See Paragraph 147

Photo by T. E. Dillon

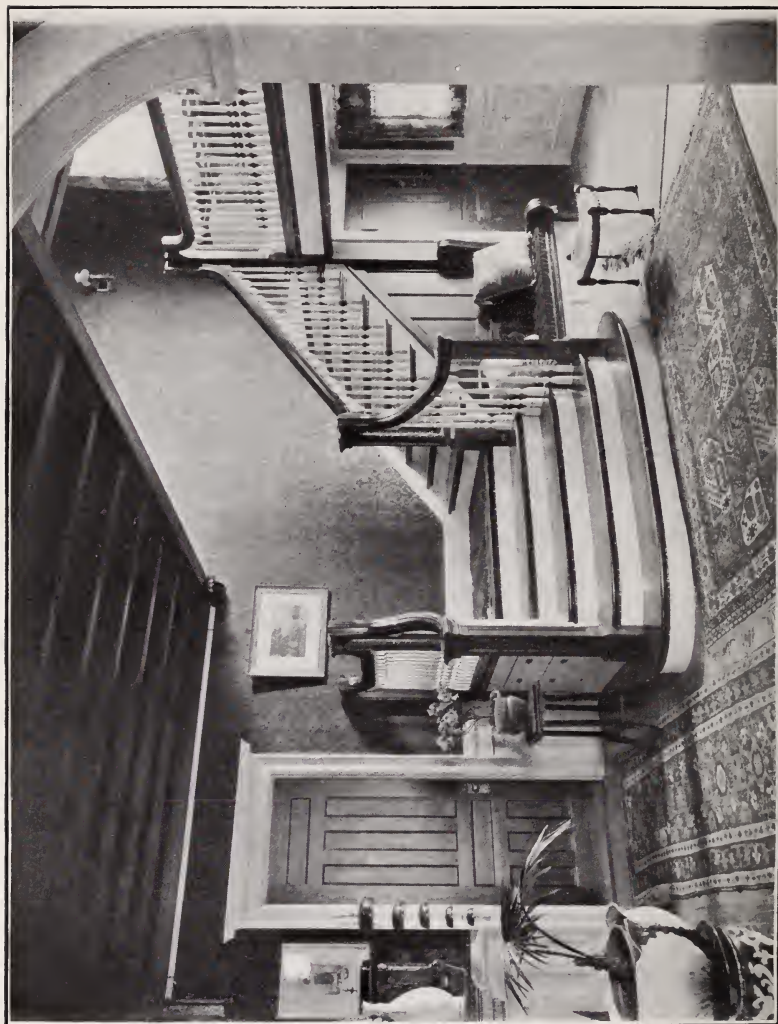


Photo by T. E. Dillon

Illustration No. 27
Interior—Stairway
See Paragraph 148

148. Illustration No. 27 gives a detailed view of a stairway. This picture was made especially for the architect, and shows clearly the general construction of this particular feature and its harmonious setting with the general surroundings.

149. **Detail and Harmonious Arrangement.**—In a general way, it may be stated that when photographing interiors of residences, detail and a harmonious arrangement of the various articles are of prime importance. Try to avoid having any set arrangement, and also aim to have the lighting effect as uniform as possible. A very common error is to have the foreground or the front portion of the view strongly illuminated and the distance lacking in detail, giving the appearance of nothing more than a mere mass of meaningless black. If this difficulty presents itself, the source of light should be diffused by either drawing the lace curtains across the window, or stretching a piece of cheese-cloth over it. Then, by giving a sufficient amount of exposure to secure detail in the deepest shadows, and developing for the highest points of light, you will secure a perfectly satisfactory result.

150. Illustration No. 28 is a view taken on a veranda, one of the most difficult of subjects known to the photographic worker, and especially so when all wood work is of very dark color. Notice the excellent detail throughout, the lack of heavy shadows, the natural appearance of the landscape in the distance, and the harmonious general arrangement of the whole picture. The secret of the success in making this picture was due to giving proper exposure and correctly developing it. The negative was made and developed according to the method described in Volume II. (Special Development—Part II.)

151. **Typical Interior Examples.**—As the illustrations given herewith are typical of the average interiors, a most careful study should be made of them, as they will give a better idea as to the arrangement, lighting effect, etc., than is possible to explain by words alone. After a little practice and experience, and following the suggestions

given herewith and in Volume VI, on photographing interiors, one should have no difficulty in securing most excellent commercial results.

152. **Church Interiors.**—Good photographs of church interiors are usually admired for their technical qualities. Their massive architecture makes them very interesting, yet at times somewhat difficult subjects to photograph. The chief cause of this difficulty lies in the stained glass windows used for illumination, which, although admitting visual rays of light, do not permit of a large amount of actinic rays entering. For this reason one is easily deceived by the image on the ground-glass, which, from its distinctness, will lead one to believe that a full exposure can be secured in much less time than is actually the case. The red and yellow glass in the windows is responsible for the retarding of the actinic rays of light. The more the red and yellow glass predominates over the white and clear glass the longer will be the required exposure.

153. There is invariably a large window directly back of the altar or pulpit and as it is usual to photograph from the rear of the room toward the front it will be necessary to include this window. In order to avoid any serious effects from the spreading of light, the use of non-halation ortho plates are recommended. It is, however, possible to work with ordinary plates, and by properly manipulating them according to the methods given in Volume II, *Special Development*, Part II, fully as good, if not superior, negatives will result as when using the non-halation plates with ordinary development. When the non-halation ortho plate is used in connection with the special development still better results may be obtained than if the ordinary plate were used.

154. Illustration No. 29 shows a technically good photograph of a church interior. The important consideration in church interiors lies in the selection of a point of view to overcome a repetition of lines and avoid parallel lines as much as possible. You will observe there is no repetition of lines in this view and the entire composition is such as to give an exceedingly pleasing effect. There



Illustration No. 28
Veranda
See Paragraph 150

Photo by T. E. Dillon

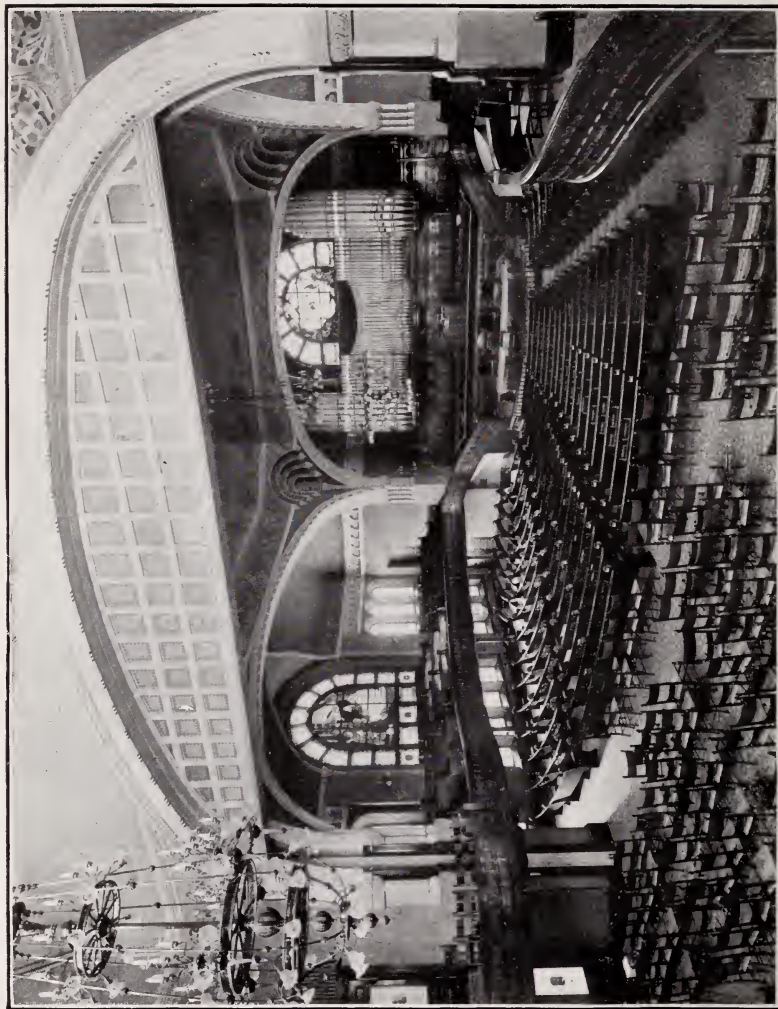


Photo by T. E. Dillon

Illustration No. 29
Interior—Church
See Paragraph 154



Photo by T. E. Dillon

Illustration No. 30
Interior—Church
See Paragraph 155

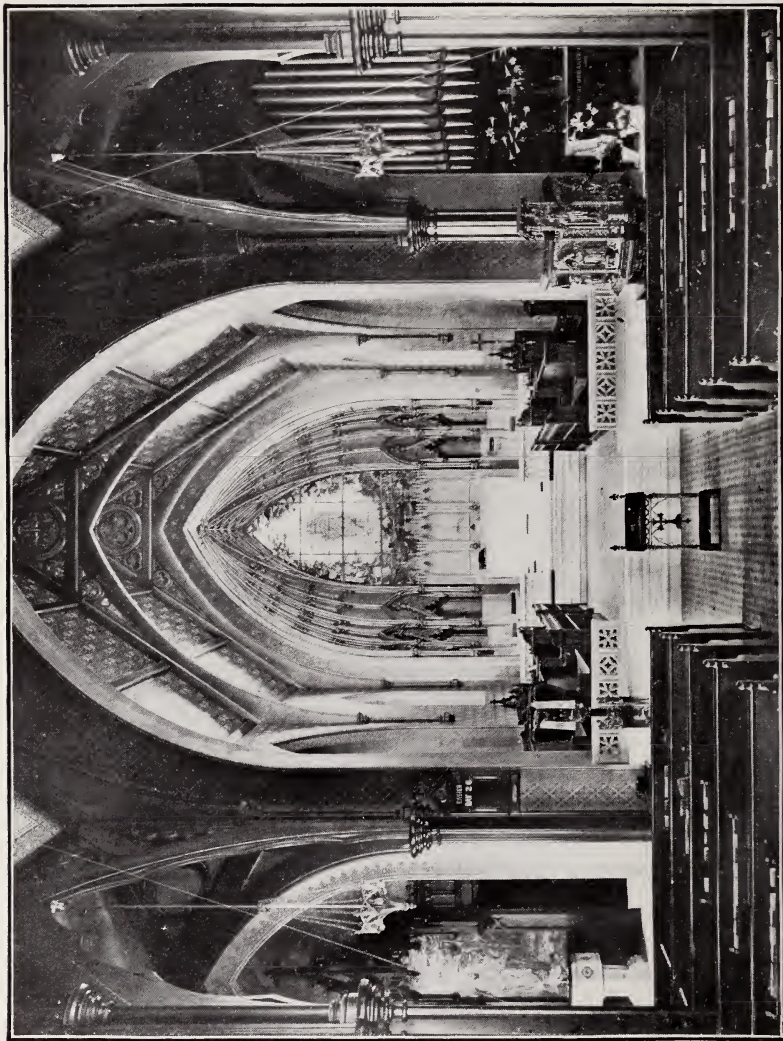


Photo by T. E. Dillon

Illustration No. 31
Interior—Church
See Paragraph 155

is almost a total absence of halation. The lighting effect, however, is very natural, and although the subject was an exceedingly difficult one to handle, full detail has been secured in the deepest shadows, while the high-lights are not chalky.

155. In contrast to this general interior view we show two views in Illustrations No. 30 and No. 31. These two views are intended to give an idea of the massive detail work around the altar, and in order to represent it truthfully it was necessary to take a straight front view. Although this gives a uniformity of line on both sides of the center, it is not at all displeasing, and from an architectural standpoint is perfectly correct.

156. **Time of Day.**—The light conditions will have much to do with your success or failure with this class of subject. You should try to make the exposure when the sun or strong light is not on the windows included in the view. Then, again, the sun should not strike those windows which supply the strongest amount of illumination.

157. **Weather Conditions.**—When the weather is very bright a good time of day for such exposures is at the noon hour when the sun is directly overhead. You will then have more even illumination, yet have snappy high-lights with illuminated shadows. It is far better to make church interiors, if you rely on daylight alone for your illumination, when the weather is slightly cloudy, as this will give much softer results. A longer exposure, of course, will be required, and it may be necessary to give double the exposure under such conditions as when the sun is shining brightly.

158. **Plates to Use.**—The rapid non-halation ortho plate is best for this purpose, yet the ordinary rapid plate will be found very satisfactory, especially when the *Special Development* is employed. It must be remembered that when the special method of development is employed, from three to four times the normal exposure must be given.

159. **Exposure.**—The exact amount of exposure required for all such work cannot be given here, as there are

few interiors giving the same amount of actinic light, or that are arranged in the same manner. Frequently the exposure will be at least half an hour long. In the majority of cases, however, it will be far in excess of this. Sometimes it will be necessary to leave the lens uncapped for several hours, in order to secure proper detail in all portions of the interior. Careful study of the exposures given the interiors illustrated herein, and a little practice and experience, will enable you to judge quite accurately, by the appearance of the image on the ground-glass, the amount of exposure necessary.

160. Stores, Store-Fronts and Bank Interiors.—The photographs of interiors of stores, show-windows, banks and business places are made usually for advertising purposes. Banks are sometimes photographed for their architecture. Even then, if views are made with the idea of giving one a general impression of the appearance of the interior of the building, the point of view is all important. The view should be made from the main entrance to the building; so if the photographs are used for advertising purposes, customers upon entering will recognize the place by the picture published. The next consideration is the general arrangement of the interior and the light conditions.

161. Illumination.—Most store rooms receive all of their illumination from the large front windows, thereby causing the strongest light to fall on the objects nearest the camera. If the room is very deep (long) you will, usually, find a skylight in the center of the room, which supplies illumination for the central parts, and as the rear of the room usually has a few small windows, there will be sufficient light to illuminate the entire room uniformly. The light for interiors of store-rooms, banks, etc., like all interiors, gives better effects at some hours of the day than others, and usually, when the light enters the room at a slight angle, it gives better results than if falling broadly on the objects. With the light falling at an angle you have some slight shadows which give relief to the high-lights, thus overcoming flat effects.



Illustration No. 32
Interior—Hardware Store
See Paragraph 104

Photo by T. E. Dillon

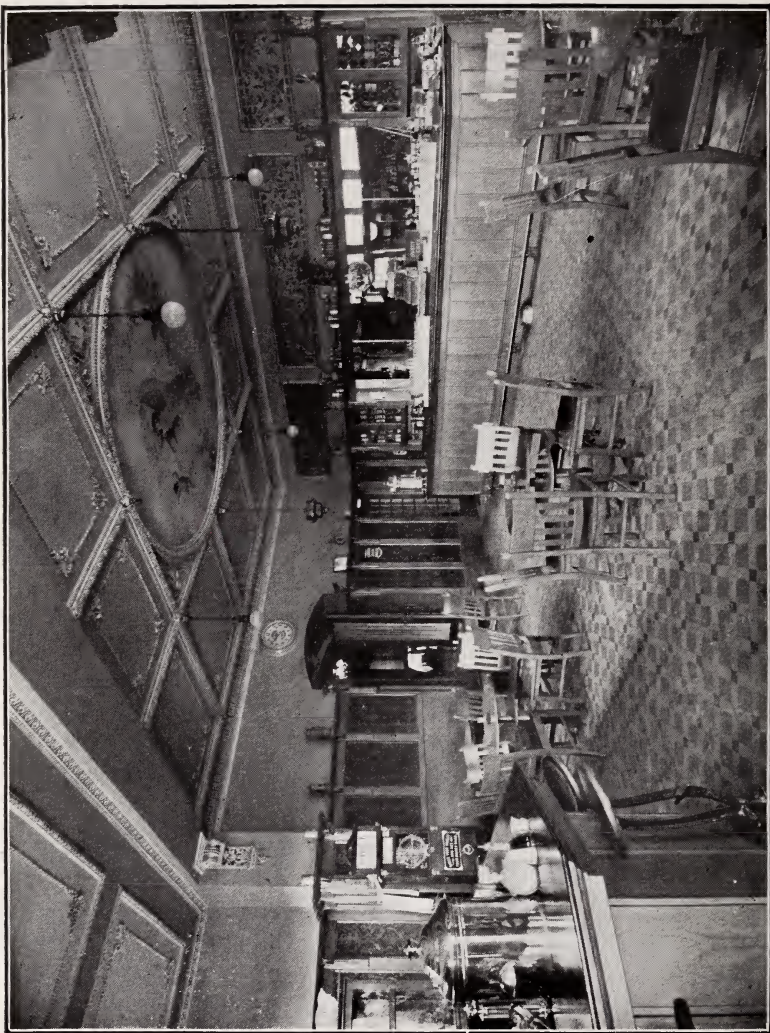


Photo by T. E. Dillon

Illustration No. 33
Interior—Café
See Paragraph 167

162. **Attention to Foreground.**—A very important point for consideration in photographing store-rooms is to avoid a crowded foreground, and also the placing of large objects in the immediate foreground which will not only appear out of proportion, but will dwarf all small articles by comparison.

163. **Point of View.**—Strive to secure uniformity and general balance throughout the view, and select a view-point that will give the observer an idea of the general appearance of the *room* in its natural state.

164. It is never advisable to have a set appearance of the articles in the room, and the camera should be located so as to give proper balance to the picture space. Do not point the camera directly down an aisle unless it is absolutely necessary. Notice the point of view chosen when making the photograph in Illustration No. 32, which gives one a good idea of the general arrangement of the store, yet the picture is void of any attempt at special preparation for the picture.

165. **Illuminating Rear of Long Rooms.**—Where there is not sufficient daylight to illuminate the rear of the store, or if there is no skylight for the center of the room, the use of a small charge of flash-powder, or even a few pieces of magnesium ribbon located back of some pillar or large object, obstructed from view of the camera, will illuminate the room and will not fog the plate.

166. In Illustration No. 32 the above mentioned conditions existed, and it was necessary to burn a little powder at the end of the counter, on the right-hand side, and also behind the desk, which is farther down in the room.

167. Illustration No. 33 supplies a good interior view of a gentlemen's restaurant and bar. While this room is arranged practically square, which is a difficult condition to illustrate in one single view, yet in this picture we get a good idea of the appearance of the place. The picture was made from one corner of the front of the room, with illumination from the side and front, which would be back of the

camera, thus quite evenly distributing the light over the entire space.

168. In Illustration No. 34 we have a view of a section of a rug store. This picture was made for advertising purposes. In arranging the rugs for this picture, you will observe that large rugs are used to form the background, and in order to break the monotony, stacks of small rugs are arranged in the center of the background; while to break up the flat foreground and supply some high-lights and shadows, single small rugs were gathered up and distributed promiscuously on the floor. The illumination was supplied from four windows, two on each side. In Illustration No. 35 we have another picture of goods grouped together for use in advertising. For the purpose of this picture the goods were arranged in the front part of the store thus permitting them to be seen upon first entering. The illumination coming all from the front windows, gave a good light, resulting in an excellent picture. Illustration No. 35a, which shows engine models, as well as models of various engine parts, is reproduced here to illustrate the best method of illustrating subjects which are practically all dark in color, with occasionally brightly illuminated surfaces. This photograph was made without dulling the surface of the metal, but a double source of illumination was employed. The *display* was placed about 20 feet from the two windows, which latter were about 15 feet apart, the camera being located between them. In this way a front view of the *display* was secured, and the light coming from both sides of the front fully illuminated all shadows, something which could not have been properly accomplished if a straight front or a straight side light had been employed.

169. **Window Displays.**—One of the most difficult subjects to photograph by daylight illumination is *window displays*, the trouble arising from reflections which invariably occur under ordinary conditions. Illustration No. 35b is a reproduction from a very successful photograph made in daylight. Observe that the view-point selected was very low, as at such a height there is a minimum amount of re-



Illustration No. 34
Display—Rugs
See Paragraph 168

Photo by T. E. Dillon

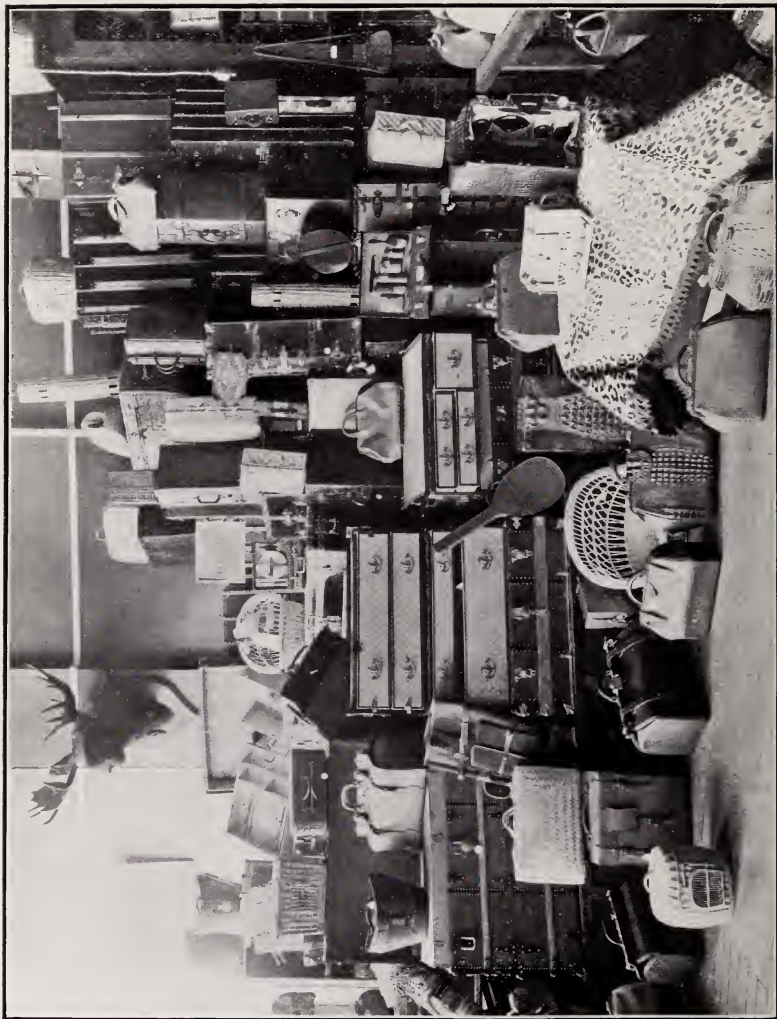


Photo by T. R. Dillon

Illustration No. 35
Display—Leather Goods
See Paragraph 108



Illustration No. 35a
Display of Engine Models
See Paragraph 168

Photo by T. E. Dillon



Photo by T. E. Dillon

Illustration No. 356
Window Display—Daylight Illumination
See Paragraph 169

fection. High buildings on the opposite side of the street also materially do away with reflection. The bad effects of light objects, and especially the sky, being reflected in the window will be observed in the upper part of this illustration. There is usually a certain time of day when a window display will appear with less reflections than at other times; the location of the window as to how it faces the sunlight has much to do with the selection of time of day when the least amount of reflections appear in the view. Usually to secure the best daylight illumination one should choose a time of day for making the exposure when direct, strong sunlight falls on the window. Under such conditions the window display will be fully illuminated, and, further, the objects on the opposite side of the street will be in shadow, thus reducing to a minimum any possibility of reflection. The greatest amount of trouble in photographing window displays will be experienced on dull days, or when the sun does not strike the window being photographed. The most satisfactory results, however, will be obtained in the evening, when the windows are illuminated by electricity. Usually the lights are so concealed that they are not visible to the passerby—the rays being concentrated upon the display. This is exactly what is desired by the photographer, as all lights should be shielded so that the rays of light will not strike the lens. If the back of the display window is open, be sure that all lights in the store are extinguished, otherwise they will produce ghostlike effects. Should there be objectionable lights on the opposite side of the street they should be turned out, if possible, or a view-point chosen that will bring their reflected image out of the view. This class of work cannot be hurried and one must study carefully each and every feature, remembering that there are innumerable chances for reflections appearing on the sensitive plate, which might have been overlooked when focusing. The height of the camera is a factor that must also be considered, but usually a low view-point should be chosen, as from such a point reflections of objects which are of an equal height as the window will be done away

with. Illustration No. 35c is an average example of a commercial photograph made at night to show window displays.

170. Illustrations No. 36 and No. 37 show **bank interiors**. Both of these receive illumination from the skylight, also from the front windows, and by this general illumination it was much easier to secure a proper lighting effect without the use of magnesium ribbon or powder. Carefully observe the point of view chosen when making both of these pictures.

171. Illustrations No. 38 and No. 39 show a vault door closed in the one case and open in the other. In making these two illustrations the aim was to show in detail the construction of the door and its manner of operation. The original prints were 11 x 14 inches in size, and in reducing for reproduction much of the detail has been lost, yet the general construction and appearance are easily seen. Daylight supplied the illumination for both exposures. Whenever possible to use it, daylight is preferable to artificial light. There are cases, however, when it is impossible to take advantage of daylight in order to fully illuminate the deepest shadows; therefore, artificial light must be resorted to.

172. **Factories.**—The securing of photographs of the interiors of factories is one of the most remunerative branches of this part of photography. From the fact that the photographer is looking for business, he will make it a point to thoroughly acquaint himself with different manufacturing establishments and secure a series of interior views. In the first place, these readily sell to the employees, but the main object in making photographs should be to secure a set of views showing the various departments. When the pictures are finished these may be shown to the management, who in turn will generally purchase them to be used for advertising purposes, particularly for illustrating booklets. If the photographer is progressive he will not wait to be asked by the manufacturer to make these photographs, but will take the initiative and actually go out



Illustration No. 35 c
Window Display—Artificial Illumination
See Paragraph 109

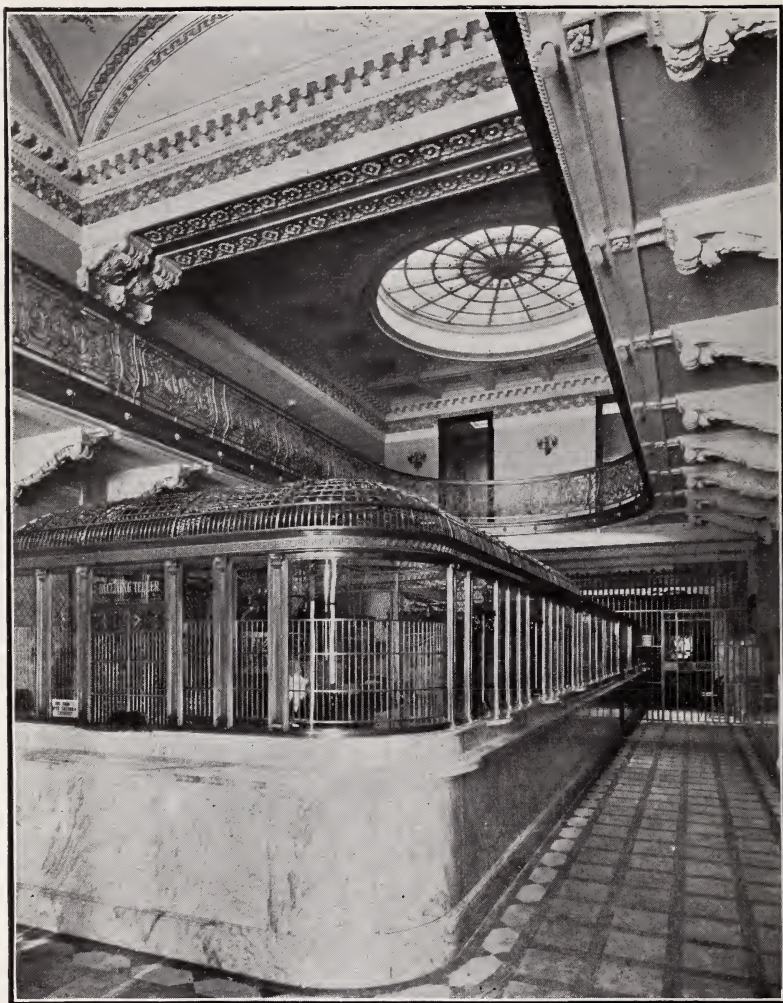


Photo by T. E. Dillon

Illustration No. 36
Interior—Bank
See Paragraph 170

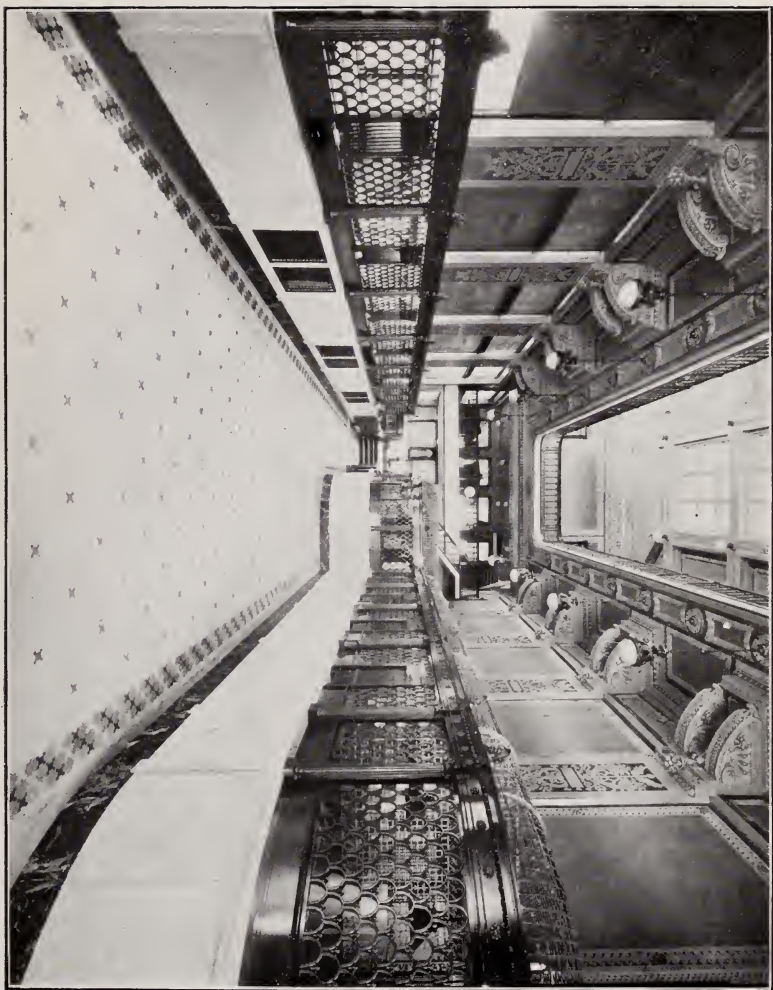


Illustration No. 37
Interior—Bank
See Paragraph 170

Photo by T. E. Dillon

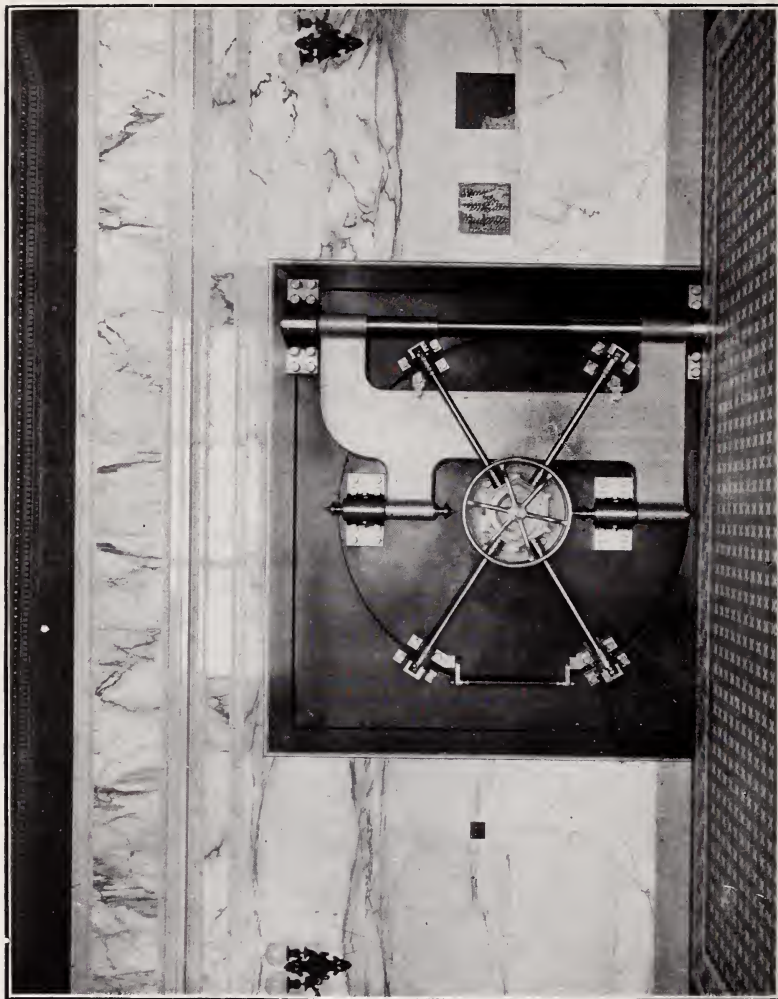


Photo by T. E. Dillon

Illustration No. 38
Vault Door—Closed
See Paragraph 171

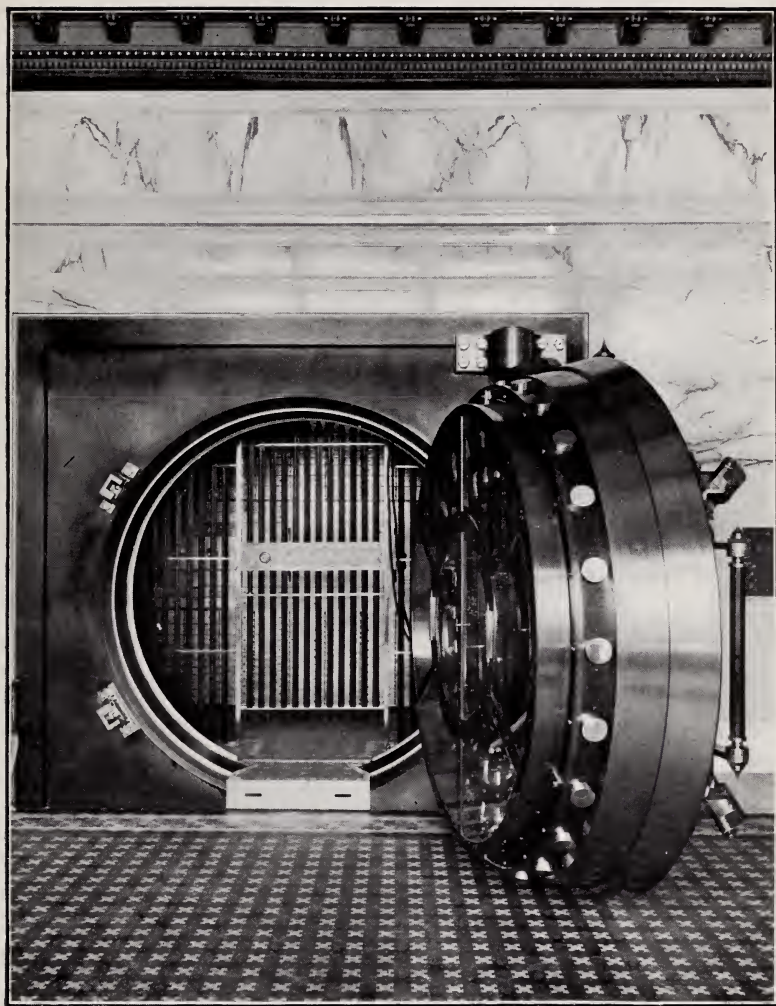


Photo by T. E. Dillon

Illustration No. 39
Vault Door—Open
See Paragraph 171



Photo by T. E. Dillon

Illustration No. 40
Interior—Composing Room
See Paragraph 173



Illustration No. 41
Interior—Press Room
See Paragraph 174

Photo by T. E. Dillon



Photo by T. E. Dillon

Illustration No. 42
Interior—Filing Department
See Paragraph 175

after business, and there is no reason at all why success should not be met with.

173. Illustration No. 40 shows the interior of a **composing-room** of a large printery, which is excellently illuminated by the skylight, as well as by side windows. The subject was not at all difficult to handle, as the illumination was very uniform throughout the room. The point of view chosen was one which included the foreman's desk and shows the room to best advantage, giving one a good general idea of the arrangement and appearance of this department. A non-halation plate was used, and owing to the even illumination only a short exposure was required, even with the lens stopped down quite small to give good depth of focus.

174. Illustration No. 41 shows one of the **press-rooms** of a printery, which was lighted only by side windows, yet by giving the proper amount of exposure full detail was secured in all parts, and a very truthful rendering of the view obtained. The principal consideration in making this picture was the selection of point of view from which to make the picture to give a general idea of the appearance of this department.

175. The photograph reproduced in Illustration No. 42 shows an **office filing department**, which was lighted by side windows. By using a non-halation plate an excellent result was secured. Notice that the general arrangement is very pleasing, and that the point of view chosen was such as to show all of the room to its best advantage. A position more central or more to the right would not have given this effect; in fact, the whole appearance would then have been very set, as too much blank space would have been admitted in the foreground.

176. Illustration No. 43—a portrait made in the office—gives a good likeness of the individual. This picture would very aptly find a place in a catalog, together with the three previously mentioned views. An exterior of the building and half-a-dozen more interior views, showing perhaps more detail work, such as the linotype machines

with their operators at work, some of the large cylinder presses, the book-binding machines, the immense paper cutters, etc., all would find a place in a representative catalog of a large printery of this kind.

177. **Machine Shops, Engine-Rooms,** etc., as well as an endless variety of manufacturing industries, may be photographed to advantage, but the general principles involved throughout are approximately the same. The important points to bear in mind, however, are: First, the light; next the point of view; then sufficient exposure; and finally the development. As a general rule daylight may be used as the illuminant, but there are times when it will be necessary to resort to the use of artificial light in connection with daylight. If, however, the interior is illuminated with high-power arc-lights, it will be possible to make the exposure without resorting to flash materials. Wherever possible one should aim to use daylight, as better results will be obtained, especially by beginners. The manner of using artificial light is fully described in Chapter XIX on Artificial Light.



Photo by T. E. Dillon

Illustration No. 43
Portrait in Private Office
See Paragraph 176

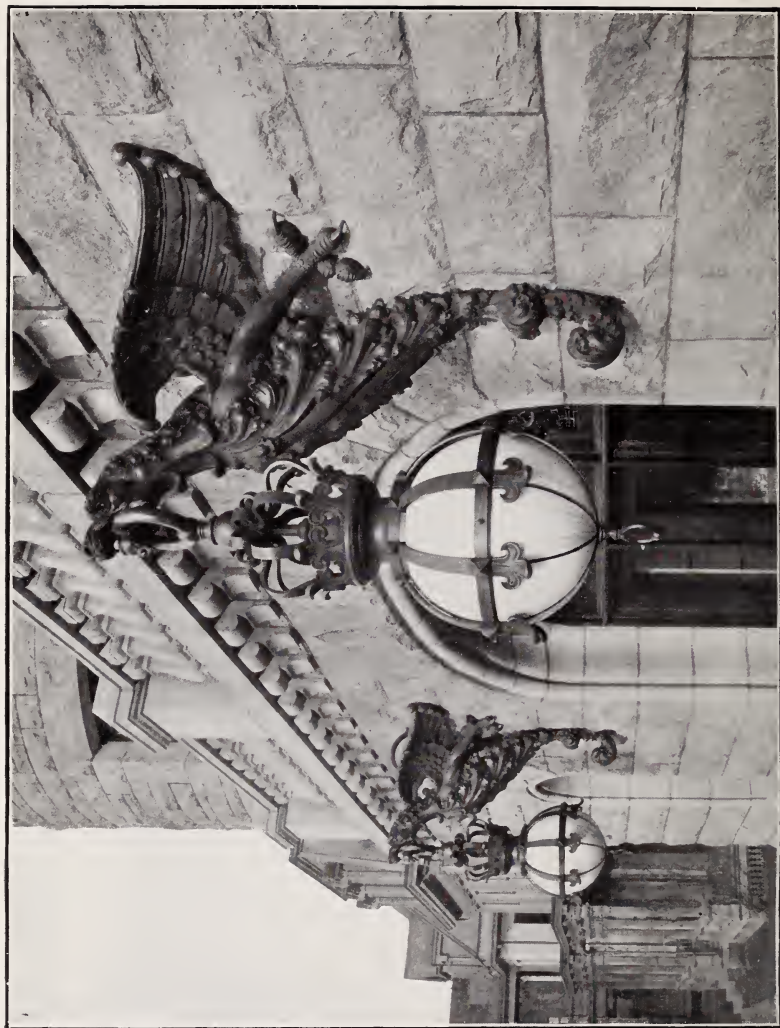


Photo by T. E. Dillon

Illustration No. 44
Architectural Detail
See Paragraph 179

CHAPTER VII.

Architectural Detail.

178. The photographing of architectural details is extremely interesting, yet until recent years little of this class of work was undertaken except by the amateur photographer. Architects, designers, contractors and builders all realize the value of photographs of this nature. In consequence, the commercial photographer of today is giving this class of work more careful attention. Perhaps a reason for lack of interest along this particular line, by the photographer doing general photographic work, is that such subjects do not lend themselves easily to pictorial treatment or afford scope for artistic rendering; yet a series of such photographs properly produced will create far greater interest than many others of pictorial value. There is hardly a church or public building of any description that does not abound with excellent subject material, and especially those of stone and concrete construction. The capitals of pillars, ornamental panels, bosses, and endless carvings, all form excellent subject material.

179. **Outfit Necessary.**—Some amount of work can be done with a hand camera, but the ordinary view camera with long bellows extension and the addition of a low power telephoto lens will be found most useful. In the absence of the regularly constructed telephoto lens, a single combination of the ordinary rectilinear lens will answer very well, for with the single combination, working from the same viewpoint, you produce double the size image on the plate. The proper use of even the ordinary rectilinear lens enables one to obtain records of many interesting subjects which the untrained user might consider quite out of range and beyond the capabilities of the ordinary lens. Illustration No.

44 is an excellent example of this class of work. For detailed description of how this picture was made see the department, *How Studies were Made*.

180. **Avoid Vibrations.**—Great care must be taken to avoid vibrations during the exposures, when using the telephoto attachment, or even the single combination of your regular lens, for the distance between the lens and sensitive plate is so great that the slightest tremor is fatal to good results. A firm tripod is, therefore, a necessity, and when the bellows is fully extended an additional brace from the base part to the tripod is advisable (see Illustration No. 45), for a sudden breeze or even the uncapping of the lens, is apt to cause trembling.

181. **Illumination—Clear Atmosphere.**—To obtain the best results for detail work a clear atmosphere is essential, but direct sunlight is generally a disadvantage, for with the sun shining on the object you have heavy shadows to contend with, which are undesirable for this class of work, as clear detail is the essential feature. For general field work, of course, where the single combination lens is employed, in order to bring the object closer to you, then strong sunshine is essential, as this gives strength to the view, where without strong sunlight, the view is very apt to appear flat.

182. **Telephoto Exposure.**—The amount of exposure to be given where the regular telephoto lens is employed, may be very easily reckoned by referring to the table given in Volume VI, in Chapter XLII, Telephotography. As a rule, where the image is doubled in size, giving you four times the area, you will require four times the exposure that would be necessary from the same point of view with the doublet or complete lens.

183. **Adjustable Tripod Top for Details.**—For some detail work the camera has often to be tilted considerably and in such cases a tilting tripod top should be employed. With this attachment any amount of tilt, even to a perpendicular position, may be obtained, without fear of the apparatus collapsing. See Illustration No. 1.

184. **Ceiling Detail.**—If much work is to be done with



Photo by T. E. Dillon

Illustration No. 46
Interior—Ceiling Detail
See Paragraph 186



Illustration No. 47
 Interior—Ceiling Detail
 See Paragraph 186

Photo by T. E. Dillon

the camera and lens pointed upward for bosses or ceiling details, a tilting, or adjustable, tripod top is a great convenience, for all detail work requires a visual inspection of the focusing screen to secure sharpness. In the absence of a tilting tripod top, when the object allows of a lens of normal focus being used, the camera can be taken off the tripod and simply placed lens upward on a table or even on the floor, when it should be carefully leveled in both directions horizontally. The focusing scale must, of course, be used in a case of this kind.

185. **Methods of Focusing.**—If your camera is not equipped with the focusing scale, estimate the distance from the ceiling to where the lens will be when making the exposure; then focus the camera on some object located at an equal distance. Leave the lens set at this position, and then place the camera on the floor or table, or whichever distance you have estimated from, to secure the view you desire to include.

186. Two examples of ceiling detail are shown in Illustrations Nos. 46 and 47; the former is taken with a rapid rectilinear lens of 16-inch focal-length, stopped to U. S. 64; the plate used was a 11 x 14 Standard Orthonon with a twenty minutes exposure. The other example was made with the same lens fitted with a Bausch & Lomb ray filter. The lens was stopped to U. S. 32; the plate used was a Standard Orthonon; exposure given, 10 minutes. When photographing the dome the tilting tripod attachment was used, owing to the necessity of having to focus very accurately. The other view, however, being 12 feet from the floor, the camera was focused on an object 11 feet away, and when placed on the floor with the lens pointing upward a perfectly sharp image was secured, without any great amount of stopping down of the lens. For further data regarding how the picture was made, see department, *How Studies were Made*.

187. **Stained Glass Windows.**—Usually stained and figured glass windows in churches, residences, etc., are considered quite difficult subjects to photograph. They are

generally composed of highly colored glass, ranging in tone from a deep blue to a rich red. The principal difficulty in photographing stained glass windows lies in the overcoming of halation.

188. **Weather Conditions.**—Owing to the concentration of light on the window, a dull day should be selected for photographing, as this will not only assist in overcoming halation, but will also give more softness and evenness of tone.

189. **Plates and Color Filters.**—While the use of non-halation ortho plates will assist materially in overcoming this halation, yet even with their use, unless the plate is properly exposed and specially developed, one will not produce the best of results. By means of the *Special Development* method given in Volume II, even with the ordinary plate good results may be secured. Of course, still better results may be obtained if a non-halation color sensitive plate be employed and developed by the special method above mentioned. A four-times screen used with these special plates will be found of value to those who are not skilled in their use. Many of the expert commercial workers use only the ordinary plate, and by means of proper exposure and special development produce results equal to those obtained when special plates are employed.

190. In Illustration No. 48 is presented a good example of this class of subjects. For complete data as to how this picture was made, see department, *How Studies were Made*.

191. **Stopping Down Lens.**—It is not always necessary to stop the lens down to any great extent. In fact, if perfectly accurate focusing is done, f. 16 will be a sufficient stop to use in many cases, yet the smaller the aperture the less danger there is of halation; therefore, it is advisable to use at least two sizes smaller stop than is required in obtaining a good clear focus, and time accordingly, bearing in mind that when the ray filter or screen is used you will require from four to ten times the amount of exposure that would be necessary if the filter were not used. The amount



Illustration No. 48
Stained Glass Window
See Paragraph 190

Photo by T. E. Dillon



Photo by T. E. Dillon

Illustration No. 49
 Statuary
 See Paragraph 192

of the increase in exposure depends entirely upon the density of the particular filter you are employing.

192. **Statuary.**—In Illustrations No. 49 and No. 50 are shown two excellent examples of the reproducing of interior statuary. The three essential points to remember in this class of work are: *First*, the lighting; *second*, the exposure; and *third*, the development.

193. **Lighting.**—The light for photographing these subjects in interiors is usually soft and diffused, and in order to accentuate the high-lights and shadows the principal light should, in a manner, fall across the figure at an angle—never directly in front of it. This is especially necessary when the statue is of nearly one color—marble or cream color—for a broad front light on a light colored statue, especially if you have white walls for a background, will give very flat effects, with no depth to the shadows. Therefore, whenever possible, the light should fall on the subject so as to cast slight shadows in the little wrinkles and folds which usually appear in the drapery portions. The direction of light, however, will usually depend upon the local conditions under which you are working.

194. If your subject is not properly located so you may take advantage of daylight, perhaps it will be necessary for you to employ artificial light, such as flashlight powder; or flashlight may be used in connection with daylight. This will be found especially advantageous when front light alone can be had. By making part of the exposure by daylight and then igniting a light charge of flashlight a trifle to one side of the figure, high-lights and shadows will be supplied, thus giving snap to the resulting picture.

195. **Exposure.**—Statuary is usually white, but sometimes surrounded by dark objects, making it difficult for one to judge the correct exposure. While the statue is the principal object, yet some attention must be paid to the surroundings, as it would mar the general appearance to have a meaningless amount of flat, lifeless shadows. Under such conditions it is best to give a little longer exposure than is necessary for the statue, and the excess exposure on

this part will supply sufficient detail in the dark background. The exact amount of exposure to give the subject will depend entirely upon the prevailing conditions.

196. Lengthy exposures are usually required, owing to the non-actinic color of the surroundings. Many times you will find excellent examples of carving, and other details, in crypts or other dark places, where very little or no daylight reaches, and for such a contingency a coil of magnesium ribbon may be employed very successfully. The exposure should be made by burning a length of magnesium on each side of the subject, to give modeling—one length being twice as long as the other. Care should be taken to shield the lens from all direct rays of the light. The amount to be used to give correct exposure will vary with the color of the object, and also the distance of the subject from the camera.

197. **Obtain Special Permission.**—*It is advisable, when working in public places, to obtain special permission to use flash-light or any artificial illumination, which as a rule, is easily obtained.*

198. **Development.**—The development should be carried far enough to secure full printing strength, but under no circumstances should it be carried so far as to lose the delicate details in the high-lights.

199. In Illustration No. 49 we have quite a light background, and all the light coming from the side accentuates the shadows in the folds of drapery, thus giving them depth and supplying general roundness and relief. In Illustration No. 50 we have a medium dark background, with all the illumination coming from one side, but entering the room at some distance from the subject, thus making a lengthy exposure necessary. The side lighting, as you will observe, gives strength and boldness to the figure. Sufficient background for the statue is admitted to give one a good impression of the general surroundings. The pillars in the background while massive in themselves, are yet a part of the picture.



Photo by T. E. Dillon

Illustration No. 50
Statuary
See Paragraph 192

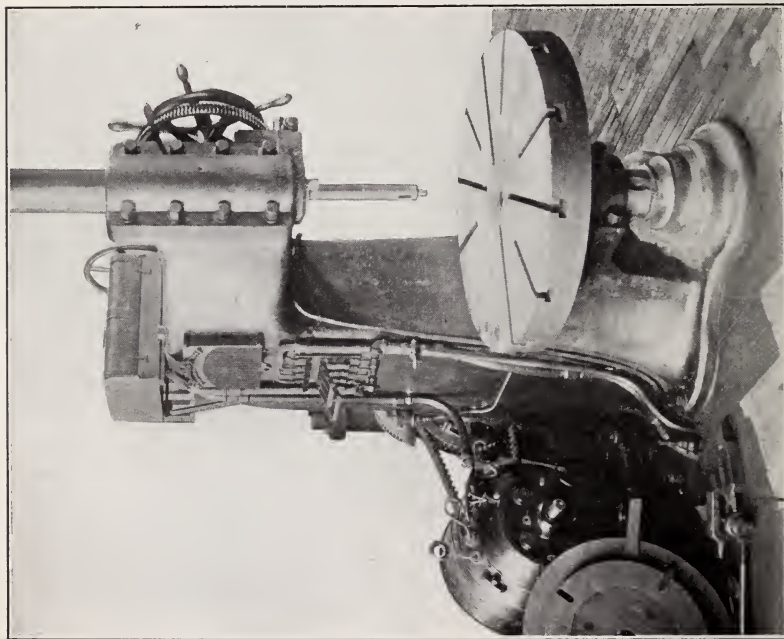


Fig. A. Use of Normal Angle Lens

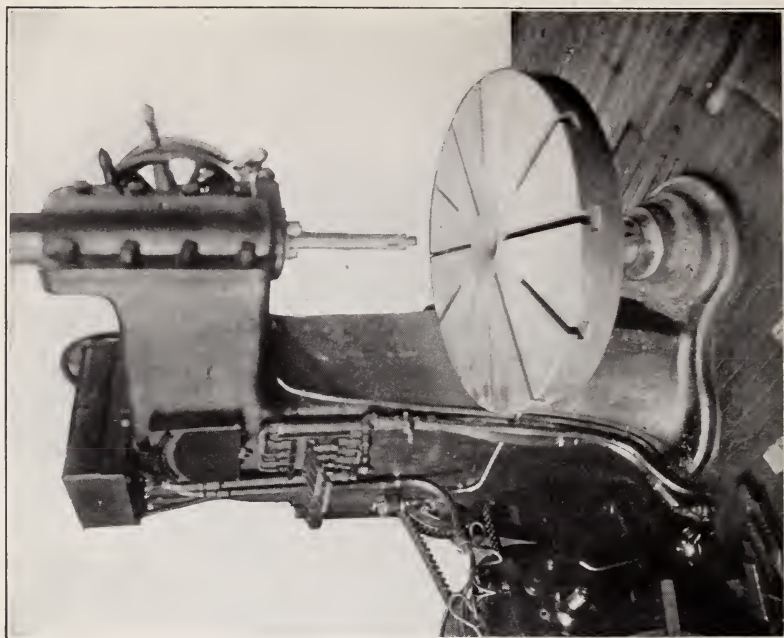


Fig. B. Use of Wide-Angle Lens

Illustration No. 51
Distortion of Wide-Angle Lens
See Paragraph 200

CHAPTER VIII.

Photographing Castings and Machinery.

200. **Introduction.**—One of the most important fields of commercial work for the photographer is the securing of perfect reproductions of castings and machinery. This work is not at all difficult, yet there are numerous points which need to be carefully considered in order that the best of results be secured. This class of work covers such a wide field that each subject cannot be taken up individually, and we will treat it from a general standpoint.

201. The majority of photographs of machinery, tools, etc., are used for catalog work and other forms of advertising. The conditions under which it is necessary for the photographer to work are often not the most desirable, yet it will be necessary that he secure the best of results, and for this reason he should be thoroughly acquainted with the various methods of controlling the light and making use of whatever illumination is at hand.

202. Little or no difficulty will be experienced in securing good negatives when it is possible to place pieces of machinery or tools under favorable light conditions, or where it is possible to move them about to receive better illumination. The difficulty presents itself when stationary machinery is to be photographed and, as is usually the case, the machines are crowded into a small space with one side placed quite close to windows, necessitating the working from the shadow side with the camera pointed toward the source of light. Under such circumstances it requires careful work to produce the best results. Therefore, the following instruction will be confined more particularly to the securing of results under difficult conditions.

203. **Equipment.**—The equipment necessary for all

classes of this work would include a view camera from 8 x 10 to 11 x 14 inches in size, according to the size prints desired, a good rectilinear or anastigmat lens, an extra medium wide-angle lens, a good rigid tripod with telescopic legs, and a magnesium blow flash-lamp or a coil of magnesium ribbon. With this outfit one is equipped for any ordinary emergency and can produce good results.

204. **The Camera.**—A regular view camera will be found the most serviceable form to use, and it should take a plate not smaller than 8 x 10 inches. Where very large objects are to be photographed a camera not smaller than 11 x 14 inches should be used. The camera should have good bellows extension, and be equipped with a swing-back or swing-bed, reversible back, and rising and falling front. A rack and pinion for accurate focusing are very essential.

205. **The Lens.**—The lens employed must give a perfect rendering of lines, and, therefore, should be of the rectilinear or anastigmat type. The regular rapid rectilinear lens will, however, answer practically every purpose where speed is not an essential factor, for this lens can be stopped down sufficiently to give an absolutely correct rendering of the subject. Owing to the fact that it is necessary to have a lens that will cover a large plate, the rectilinear type may be employed very satisfactorily by the photographer who has but limited means, and to whom the question of the expense of an anastigmat lens is an item. One can purchase two or three rectilinear lenses for the price of one anastigmat lens and with the former produce almost equally good results.

206. **Distortion of Wide-Angle Lenses.**—The focal-length of the lens is also of vital importance, for a wide-angle lens invariably gives a violent perspective and apparent distortion and does not produce a true rendering of the subject. A clear demonstration of this principle is shown in Figures A and B of Illustration No. 51. Figure A was made with a lens of good focal-length, it being equal to twice the longest side of the plate, and thus its angle is

about 40 degrees. Figure B was made with a wide-angle lens, which had an angle of about 90 degrees.

207. On studying Figure B it will be noticed that the table of this machine appears tipped, and although a very small stop was used, the drill head and the portion of the table nearest the camera are out of focus. With the exception of blocking out the backgrounds no hand-work has been done on either of these illustrations, and they, therefore, show exactly the advantages of a lens of normal angle over one of wide angle, the former giving a perfect rendering of the subject, while with the latter a very misleading impression is produced.

208. **Tripod.**—The tripod should be extremely rigid, and one of good weight should form a part of the outfit to be used for this purpose.

209. **Preparing the Subject.**—All classes of machinery will not require special preparation for photographing; generally this is necessary only when it is desired to show the article in its new state to best advantage. Even then it is sometimes advisable to have some parts specially prepared so that they will photograph to the best advantage.

210. **Parts to be Specially Prepared.**—Usually the frame-work of all classes of machinery is painted a deep green, which photographs very black. Where deep green is not used a jet black is substituted, either of which reproduces very dull and without detail. Metal, even though painted, will reflect light and cause halation, which will be very difficult to avoid even though non-halation plates are employed. It is, therefore, advisable to paint the machinery or tools with some paint which will give a good matte surface with detail in the photographic print. This paint should be such that it may be easily removed after the exposure has been made. These surfaces are usually gone over and prepared in advance by the manufacturer, with a coat of dull lead color prepared with turpentine (not oil) that is readily removed after the picture is made. The nickel or bright parts may be dulled with putty, by rolling a ball of the putty over the surface within the angle of

view of the camera. Other portions in shadow which require more detail may also be treated with the putty.

211. Usually, manufacturers in preparing machinery for photographing, which photographs are to be used for catalog and advertising purposes, paint and prepare it especially for this purpose, using neutral colors throughout, thus supplying detail. Where this method is unknown to the manufacturer, and such work is being prepared for photographing, the photographer should acquaint the former with the methods employed, thus enabling him to produce much superior results.

212. Machinery is usually photographed in the workshop, with the working machinery, belting, etc., surrounding it, requiring the blocking out on the negative of the entire surroundings, and a point of view should be chosen which will give a good, clear outline to the ends of the object. If this is impossible, a piece of white muslin or ordinary light-colored wrapping paper placed back of the ends of the object to be photographed will supply sufficient detail to enable you to trace the outline and block out the background.

213. **Dulling the Surface of Dark-Painted Machinery.**—Mix white lead with turpentine to the consistency of thin cream, with sufficient lampblack added to form a light slate color, and then add one-sixth the bulk of Japanese gold size to make the mixture adhere. Paint the machinery over with this. After the photograph has been taken the color can be readily removed with "cotton waste" moistened with turpentine or benzine. This paint should be applied to all frame-work where dark paint is usually employed.

214. **Chalking Machinery.**—On the majority of castings and pieces of machinery the maker's name-plate will be found, bolted on, or perhaps cast in some part of the tool or machine. It is very important that these raised letters be reproduced as strongly as possible. The most effective way to prepare these letters is to rub a little chalk over the raised letters, and then by means of the ball of the forefinger soften the chalk marks down, when they will be

found to stand out in bold relief. Other parts which may require this treatment are the gearing, wheels, springs, nuts, and any fine detail found in the dark portions of the object. It is really wonderful how the teeth of the gearing may be made to show up in the finished photograph, by means of careful preparation with a little powdered chalk.

215. **Study the Subject Carefully.**—One should always look over the object being photographed very carefully before making the exposure, and see that all detail within range of the lens is perfectly distinct, and that it will reproduce properly. In cases where outlines of portions of a tool or a machine are backed up with other dark parts, and therefore do not appear with enough contrast, much may be done by chalking the edges so that they appear with a light line against a dark background. The chalk when properly applied gives a slate color to the parts to which it is applied, thus rendering them a more neutral tone, which photographs with detail.

216. **Preparing Rough Castings.**—Very often it will be necessary to photograph rough castings before they have received their finishing touches. The manner of procedure differs materially from that of completely finished machinery. These castings are frequently of great weight, and, varying in their shape and dimensions, are likely to appear rough and spotted. They are generally photographed without any painting. In this condition they appear somewhat patchy and show an abundance of chisel marks from the hands of the dressers. These marks will probably present a bright, shiny appearance when viewed at certain angles of lighting, and these parts will appear quite unlike the dull gray of the remaining piece.

217. Then again, there will be other portions where large patches of dark-colored metal will almost be sure to be present. The best way to prepare the surface of castings is to forcibly throw moulder's sand on the surface or dust it on. In all dressing shops there will be no want of this material, as the castings are usually literally surrounded with sand. After the dry sand is forcibly thrown upon the

parts the surface should be gently dusted over with a little dry waste. The bright, glaring chisel marks will have disappeared and the large dark metallic patches will be as gray as the rest of the piece.

218. In all rough castings, even at the stage where they leave the dresser's hands, there will be small holes or indents on the surface, which appear in exaggerated form under side lighting. It is always advisable to doctor the more pronounced of these before exposing the plate. The best material to use is moulder's putty, which when first applied to fill up these little holes will appear as dark dots against the light gray color of the casting, but a handful of dry moulder's sand thrown forcibly on them will make the dark spots vanish.

219. **Illuminating Objects when Working Against the Light.**—The manufacturers of engines, locomotives, printing-presses, steam-pumps and other heavy machinery, usually, after preparing all the parts for these machines, assemble them together in the shop. Most work-shops are built with windows all along the sides and with the lathes and other working machinery lined up along the windows, and when machines are assembled they are usually located more in the center of the room. If there is no skylight, the illumination is naturally very poor. The space surrounding the object is generally quite crowded, and there is no opportunity for making the exposure from the window-lighted side; therefore, the shadow side is the only point from which the object can be photographed. To illuminate the object from this side is apparently quite difficult.

220. **Artificial Light.**—There are two successful ways of illuminating such subjects. The simplest and best way is by means of magnesium-powder alone, a large canvas being placed back of the object and the work entirely done with artificial light. Flashlight is not, as a rule, always successful, as the exposure, being instantaneous, gives bad shadows. Of course, one could use two machines, one on each side of the camera, yet you are apt to meet with false lights; but, by means of the magnesium blow flash-machine,

with which you can move the light about from one side to the other, if necessary, you can obtain the same effect of illumination as with daylight, and in much less time. (See illustration of Prosch Magnesium-machine, Page 231.)

221. **Daylight.**—When one is not provided with artificial illumination and daylight must be employed, it will require some curtaining and reflecting of the light, and this may be accomplished as follows:

222. First, suspend at least two large sheets back of the object, between it and the windows; next, stretch a large sheet in front of the object, facing the light, and on one side out of range of view of the camera. This latter sheet is used as your reflecting screen and should be arranged at a slight angle to the floor so as to reflect the light slightly upward against the object. If arranged perpendicularly the light would very likely be reflected down toward the floor.

223. **Operating the Screens.**—To operate the screens successfully will require several assistants. While the reflecting curtain remains stationary the others must be adjusted from above; therefore, with one assistant at each end of the curtain, you are ready for the exposure. First, obtain a good focus, using a one-size smaller stop than is necessary for good, clear definition in all parts; then, with the curtains raised just high enough so the light from the windows does not shine into the lens, uncap the lens for making the exposure.

224. At intervals of three to five minutes drop the curtains to within a foot or so of the top of the object being photographed, and then to overcome any halation the curtain should be kept in motion constantly, raising and lowering within the radius of a foot or more above the object. Continue this movement for about one minute at a time, then raise to the normal position for another five minutes. Usually, unless there is some general illumination in the room, such objects will require from 10 to 20 minutes exposure, and they should then be developed by *Special Development*, according to instructions given in Volume II.

225. **General Lighting.**—The form of lighting to employ is that which will give the greatest amount of relief and roundness to the object being photographed. Harsh and strong lighting should be avoided, as this will only tend to give hard, chalky high-lights and dense shadows. The light should be soft and diffused and when it is necessary to work close to the source of light, cheese-cloth or thin paper should be hung over the windows in order to diffuse the light sufficiently. Wherever possible, the light should fall quite broadly onto the object and at a slight angle.

226. **Illuminating Shadows.**—If the lighting is too contrasty, and if there is not a sufficient amount of illumination in the shadows, a reflector of some kind, such as white muslin or white paper, should be brought into use and light reflected into the deep shadows. Where there is much detail work in a large piece of machinery, sometimes it becomes an advantage, where electric light can be had, to run a wire, with a 32 candle-power bulb attached, from the regular socket across to the machine, locating the bulb back of some parts in the foreground, excluding it from view, but at the same time arranging it so as to illuminate some parts in shadow which require more detail.

227. Where electric light cannot be had, the use of magnesium-ribbon or magnesium-powder in the regular magnesium-machine will be found the most useful addition to your outfit, for by means of the blow-tube attached to the magnesium lamp, you can blow as light or as heavy a blast of light as you desire, and you can also move about the object while blowing in the tube, thus giving uniform illumination and overcoming any harsh shadows such as would exist if flashlight were employed, which naturally could be used from one point only.

228. **Preventatives of Halation.**—Halation will often be found difficult to prevent, especially when working toward strong light, and when it is impossible to adjust the objects so as to secure the proper angle of light. Where the object is situated under bad light conditions, such as just described, any halation about it may be overcome by arranging cur-

tains behind it and before the windows, at no time lowering these curtains below the object itself, and keeping them slightly, but constantly, in motion. As the remaining parts of the view will be blocked out anyway, halation above the object will do no harm. Where curtains are not at hand (however, shops manufacturing work of this kind are usually supplied with them), one can overcome halation to a certain extent by covering, with brown paper, the lower portion of the window which comes within range of the object being photographed. In other words, have the brown paper, or background, come one foot above the top of the object, as viewed from the camera.

229. It is far better to avoid halation at the time of making the exposure than to doctor the negative after development. The selection of the proper hour for exposure, when the direct light is not so strong toward the camera, will many times assist in doing away, to a great extent at least, with the bad effect of halation. Non-halation plates should by all means be used, unless you apply the principles given in *Special Development*, Volume II. Even when applying this method, non-halation plates will assist materially in producing better results. (See Pages 142 and 146.)

230. **Photographing Tools and Small Articles.**—The best way to photograph tools or other small articles is to lay them on the floor, or small box, covered with brown paper, opposite a window, in a good, strong light (not sunlight) and then by means of a tilting tripod top, tilt the camera so that it will point straight downward. The height the camera is arranged from the floor will determine the size of the image. Where tools or articles are highly polished they may be treated with putty, as previously described. This will overcome any glare, and if the light falls on them too strong and contrasty, by hanging a piece of tissue-paper, or preferably a strip of cheese-cloth, over the window you will subdue the light sufficiently to give an even illumination. If proper exposure is given your results will well repay your special efforts.

231. The special advantage of laying small objects on

the floor, to be photographed, is to secure reproduction without the presence of any tacks, nails, string, or other means of support, which would have to be employed if the tools were hung in a perpendicular position.

232. **Heavy Machinery.**—Among other things, one will often have to photograph large shaftings and immense castings which are extremely massive. The light conditions for such subjects, owing to their size, are usually better than smaller subjects, for, ordinarily, where such massive machinery is built there is a sufficient amount of illumination, as it is essential that the mechanics have good light to work by.

233. **Elevation of Camera.**—It will be necessary, for this class of work, to have the camera elevated at least on a level with the center of the object, and where it is extremely large the pictures may be made from a higher elevation. Where large movable overhead cranes are employed (as is usually the case in such shops) they supply a convenient point from which to work, for by taking advantage of the cranes practically any desired point of view may be secured, as they may be moved forward or backward to suit the required distance from the object.

234. Illustration No. 52 shows a photograph of five large castings of upright engines in course of construction. The view-point from which the exposure was made was about 10 feet above the ground. By judicious use of the swing-back perfectly parallel lines were secured, although the castings were of considerable height. In this illustration we have a case where the height of the engines was an important feature; also the attachments under the different iron platforms were important. If this view had been made from a higher point, looking down upon the objects, as it were, you would not show the actual height of the engines, neither would you reproduce the view as it would be viewed naturally, and besides, the platform would have cut off some of the important parts which are desired to be shown in the view. Therefore, it will be readily seen that in addition to the light conditions and other circumstances to

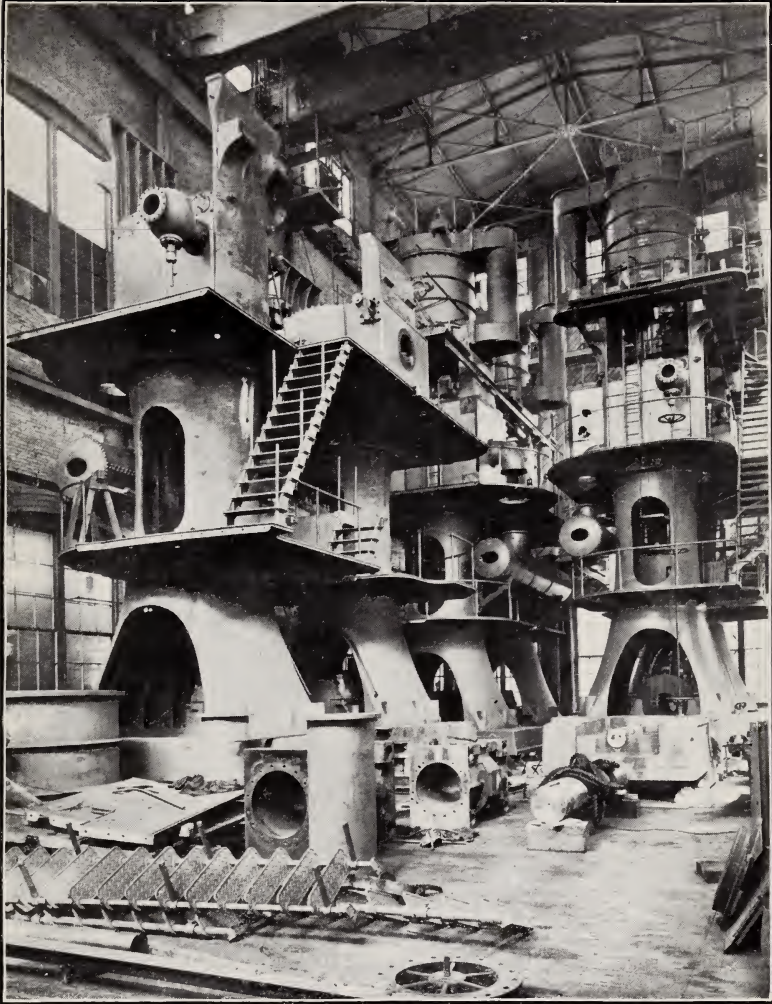


Photo by T. E. Dillon

Illustration No. 52
Machinery—Castings of Upright Engines
See Paragraph 234



Photo by Karl M. Ebert

Illustration No. 52a
Avoiding Halation
Severe Test for Special Exposure and Development
See Paragraph 241

be contended with, the object for which the picture is to be used is of paramount importance and must be given first consideration in the making of such pictures. A view-point must be selected which will give the desired impression of the appearance of the object being photographed.

235. It often happens that manufacturers desire a photograph of their machines as soon as possible after they are installed in some new shop or factory, before the flooring or other parts of the surroundings are in their finished condition. When this is the case it is advisable, before printing, to opaque the entire floor space on the negative. When the plate is dry, by means of a ruler and pencil draw flagstones on the face of the negative, inserting cross lines at their proper angles; then, with the etching knife, slightly trace these lines through the opaque when they will reproduce dark in the prints. This will give a base or support for the machine, which is very essential in all cases, as it is necessary that there appear some support for heavy objects.

236. **Photographing Machinery in Use.**—Pictures of interiors of power plants, machine shops, factories, etc., are made for use largely for advertising purposes, where the object is to impress customers and the general public, by means of the photographs, with the completeness and, perhaps, magnitude of the plant, as well as supplying evidence of the facilities for producing the goods.

237. **Point of View.**—For all such work the principal consideration is the selection of point of view from which to make the picture, giving a general view of the interior arrangement. As the different machines in use are usually located close together, to show them to their best advantage a position must be selected at some elevation sufficiently high to enable you to look down upon them—viewing them from above—rather than on a level with them.

238. In selecting the point of view, choose such a point as will give you good perspective, working diagonally across the room, showing one side and end of the

different machines. Wherever possible, the picture should be made from a point which shows the smaller machines in the foreground and the more massive ones in the distance. Where large objects are located in the immediate foreground, they exclude many small objects from view, thus giving a false impression of the plant. The height of elevation should be sufficient to enable you to distinguish each machine and the point of view for this class of work should be, as near as possible, diagonally across the space. As all such shops and factories have side windows, you will need to face the light.

239. Owing to the large area of space to be covered, a good, bright day should be selected for this work, as cross-lights from the windows will give strength and snap to the view. The best light for such work is when the sunlight is faint, but the day clear. If the sunlight is very bright, then the best time of day for such work is about the noon hour, when the sun is directly overhead. This will enable you to avoid strong reflections.

240. **Avoiding Halation.**—While working toward the source of light will, ordinarily, produce severe halation, yet by the *Special Developing Method* given in Volume II, halation may be overcome. This method should be employed for all work of this kind. Non-halation plates will further assist in overcoming halation and should be employed whenever possible. Even with such plates a long exposure—four times the normal—should be given, and then developed by the special formula, as above stated.

241. In Illustration No. 52a is presented a severe test for working against the light. Observe that while the camera is pointed directly toward the window (the source of illumination), yet there is no halation. The resulting picture is clear in detail, with snap and vigor. In Illustration No. 53 is shown a general view of a series of dynamos. The point of view selected was from an elevation of about eight feet from the floor, working diagonally across the room, resulting in a picture of practically all the machinery in the room, showing its arrangement, etc.,

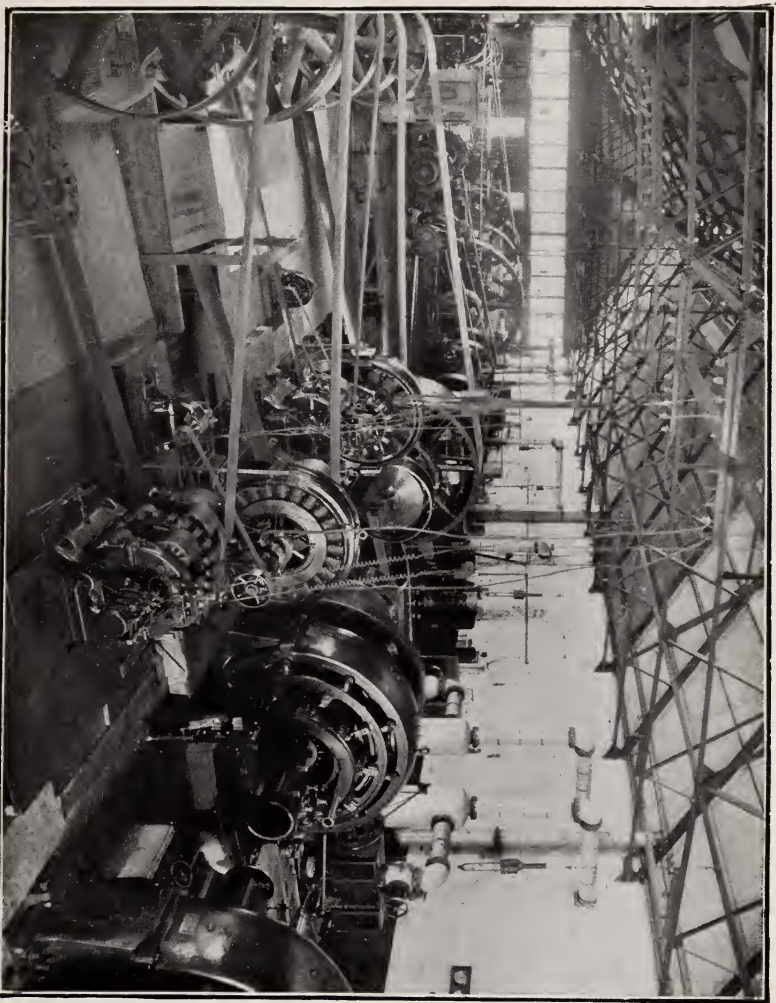
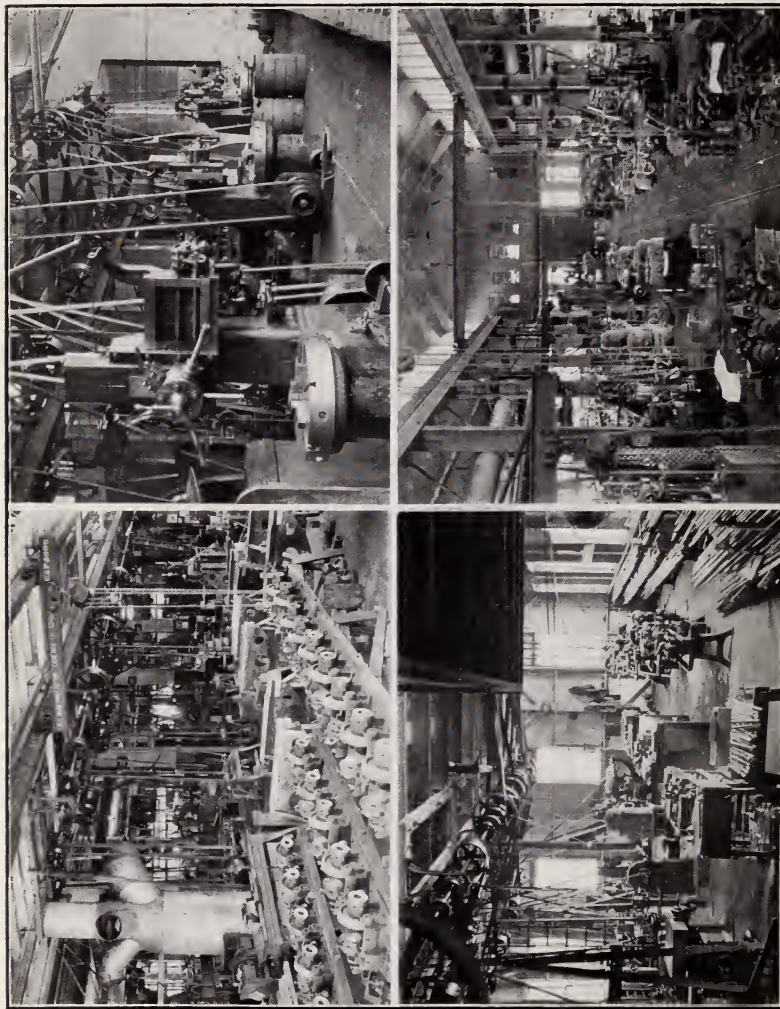


Illustration No. 53
Series of Dynamos
See Paragraph 241

Photo by T. E. Dillon



Photos by Guy E. Phipps, Franklin, Pa.

Illustration No. 53a
 Interiors—Machinery—Special Development
 See Paragraph 242

and at the same time including the iron-work of the ceiling sufficiently to give a truthful impression of the plant.

242. In Illustration No. 53a, we have a group of four views showing interior work where the special method of exposure and development was employed.

243. In Illustration No. 54 we have a radically different subject, being a cotton machine in operation. This machine was located in a basement, with all the illumination coming from small windows, falling broadly onto the machinery, resulting in a long exposure being required to secure full detail.

244. **Exposure.**—The necessary exposure for this class of work will depend entirely upon the subject, but you must bear in mind that when photographing machinery you are dealing principally with dark colored objects, which will require longer exposure in order that full detail may be secured in the shadows. It is very essential that all portions of the subject present clear detail, and, therefore, a sufficient amount of exposure must be given to accomplish this. A reasonable amount of over-exposure will do no harm as this can be controlled in the developing. A little experience will soon enable you to judge very closely the amount of exposure required.

245. **Development.**—For all important work such as above described, especially where there is any likelihood of halation, the *Special Method* for exposure and development, described in Volume II, should be employed. For all ordinary work the *Universal Formula* will answer.

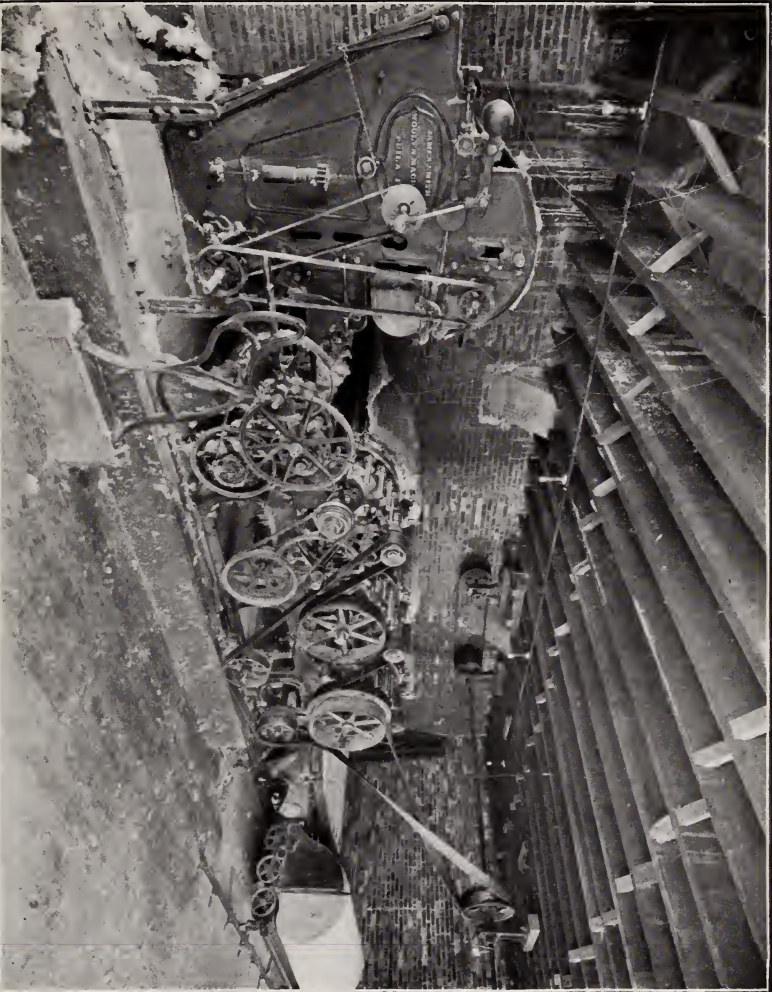


Illustration No. 54
Interior—Cotton Machine in Operation
See Paragraph 243

Photo by T. E. Dillon

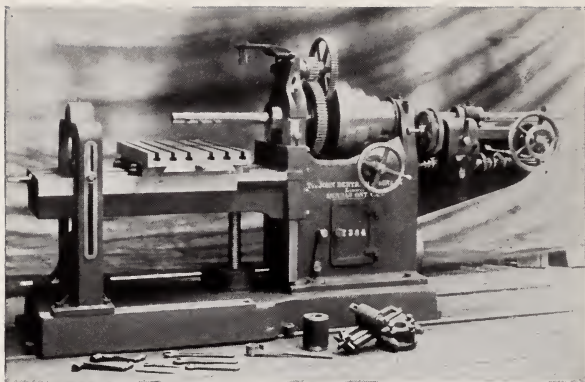


Fig. A. Plain Photograph

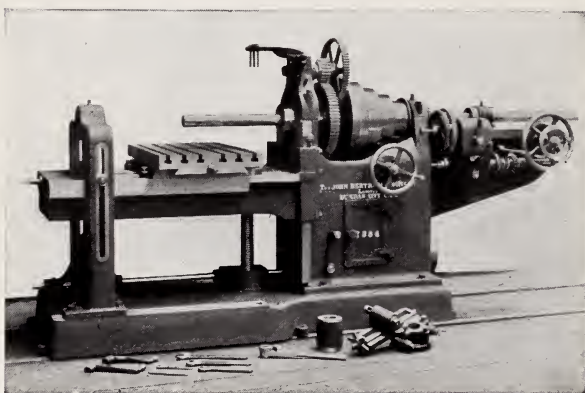


Fig. B. Negative Blocked—Detail Worked-In

Illustration No. 55
Machinery—Blocking Negatives
See Paragraph 248

CHAPTER IX.

Blocking Negatives.

246. **Blocking the Negative.**—Generally commercial photographs require white backgrounds. This effect can easily be obtained in the following manner: Sew together a couple of widths of white muslin, the length required to completely shut out all objects back of the subject to be photographed. Attach a pole to each end of this screen. The poles serve as standards for stretching the muslin, and also to roll it on when not in use.

247. When preparing the object to be photographed, stretch the screen behind the object, when sufficient white ground will be obtained to give a good, clear outline. Sometimes, where the sheet requires a good, strong light, by keeping the sheet moving during the exposure a sufficient white ground will be produced for all practical purposes, but for very large work, in order to produce a pure white effect you must resort to what is called *blocking-out*. This you do upon the negative.

248. Before blocking the negative, all alterations—such as reducing strong high-lights, building up weak parts, etc., thus equalizing the tonal values—should be made in advance of blocking the negative. By reference to Fig. A, Illustration No. 55, you will observe that the top of the machine is in very strong high-light. This was unavoidable, as you will find in many instances where such work is to be photographed, for all the illumination comes from the skylight directly overhead. In making the exposure enough time was given the plate to fully expose the densest shadows, and the plate was then developed by the regular method of development and afterward locally reduced with a weak solution of red prussiate of potash. Finally, the

background was blocked out, with the results as they appear in Fig. B.

249. The first step in blocking the negative is to outline the subject, and this is best done by applying, to the film side of the negative, liquid opaque, gamboge or Strauss Marl, or any opaque substance which will not stain the print. With a small brush charged with the opaque, trace the outline carefully, and when the outline is complete fill in and paint over all parts you wish to appear white in the print. In order that the opaque may take to the film readily, carefully wet a portion of the plate. Do this by swabbing it, only once, with a tuft of wet cotton. This will not wet the film sufficiently to injure it and the opaque will adhere to the film much easier. Should you, by accident, apply the opaque to parts not wanted, the surplus so applied can be removed with a tuft of wet cotton.

250. Where the entire background is to be blocked out white, it is best to paint only about one-half inch from the outline, then use yellow post-office paper, or any black opaque paper, for masking out the remaining background. *The mask should be cut so as to lap over the opaque.* Outline sufficiently with the opaque, however, to give a clean white background. Any openings in the object, or any open work, should also be blocked with the opaque in the same manner as the exterior portions.

251. Fig. A of Illustration No. 55, is a reproduction from a negative made of a metal turning lathe before being blocked, while Fig. B shows the method of blocking out and accentuating various portions.

252. **Another Method of Blocking.**—A very satisfactory method to employ in blocking out machinery and in working up detail is to make an enlargement on bromide paper, of the original negative, and then with white ink outline the subject and block out the background on the print. By employing this method it will be possible to darken or lighten any portions desired, or to build up letters and other detail. When the enlargement has been worked up to one's satisfaction, a copy of it can be made to what-



Illustration No. 56
Commercial Photographic Subjects
See Paragraph 253

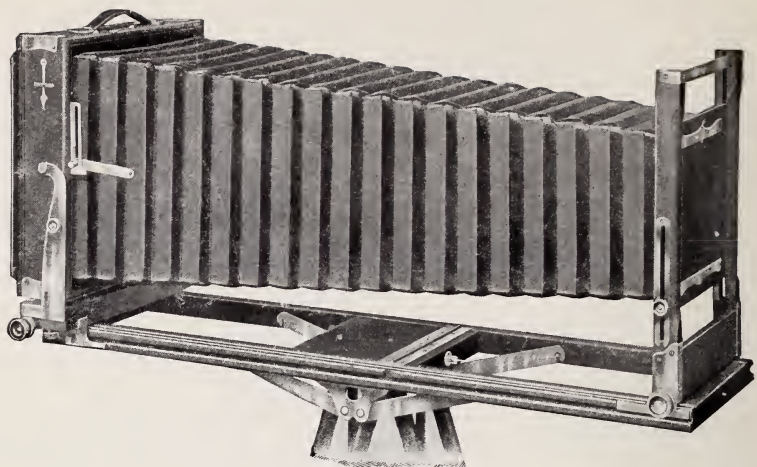


Illustration No. 45
Bed Brace for Camera
See Paragraph 180



Illustration No. 57
Commercial Photograph—Stove
See Paragraph 258

ever size is desired, and then prints made from the final negative. Where this method is preferred, a small camera may be employed, say a 5 x 7 or 8 x 10, and the enlargement made from the small plate. After the enlarged print is worked up, any size plate desired may be used for reproducing it, and contact prints made in the regular way.

253. A number of commercial subjects which have been photographed and the majority of them blocked out in the negative, are shown in Illustration No. 56. The original prints having been made from 10 x 12 to 18 x 22 plates, they naturally have suffered considerably by the reduction, yet they serve to illustrate the way such work is handled in the blocking out of the background.

CHAPTER X.

Photographing Objects Requiring Long-Focus Lenses.

254. Small objects and similar articles must be reproduced in their natural perspective to preserve their true drawing and show a semblance to their original structure. Consequently, any lens which tends to foreshorten or exaggerate the lines, should not be used.

255. By a long-focus lens, in this connection, is meant a lens of a larger size than would ordinarily be used for the same size plate. For example, where an 8 x 10 plate is used, an 11 x 14 or even a 14 x 17 lens will give better results, for the larger the lens, within reason, the better will be the perspective.

256. **Photographing Stoves and Ranges.**—Stoves and ranges belong to the class of subjects requiring a long-focus lens. For example, consider the heating stove, which may be quite high or low and squatty. The actual article itself is made with good lines and curves to give it a graceful appearance when set up in the home. This same appearance must be retained in the photograph. By working close to it, which would be the case if a short-focus lens were used, you get distortion of lines and only cover the front of the stove, while with the larger or longer focus lens, you admit more of the object—*i. e.*, you see farther around it—thus producing more natural lines in the picture.

257. With ranges we have another feature to consider, the top of the stove and the stove proper being square (box-shaped) and setting quite low and squatty. In order to show the top of the stove and hold it in true perspective, and at the same time admit to view the design of the base-frame, also the legs supporting the frame, we must work at some distance from the object so as to enable us to see

around it, as it were. The depth of the stove, measuring from the point nearest to the camera to the most distant point from the instrument, will, in many cases, exceed three feet. With a short-focus lens the distortion would be enormous, and a larger size lens must be employed if correct drawing is to be preserved.

258. In Illustration No. 57, we have a reproduction from an 11 x 14 plate, made with a 16 x 20 rectilinear lens, which you will observe gives a natural perspective and a pleasing appearance of lines to the stove.

259. **Lighting the Object.**—Stoves should be lighted with a broad front, subdued light, and as such articles are usually photographed at the foundry, the stock-room is generally selected for the purpose. A corner of a room with windows on the side and front gives ideal conditions under which splendid illumination should be obtained. With these conditions the stove should be located, say, 25 feet from the end of the room and 10 to 15 feet from the side. The camera should be located in the corner of the front of the room, thus viewing the stove or object diagonally across the room. The stove should be placed on a platform, say 6 to 8 inches high, and facing broadside to the front windows. With the camera located in the corner you will have a view of the stove showing the front and one side, all in good light. When such work is made under the regular studio skylight, the arrangement of the object is exactly the same, and the camera is worked from one side (the skylight side) of the room, thus viewing the object diagonally across the room, when both side and front of the stove will receive even illumination.

260. **Height of Camera.**—The camera, attached to the ordinary tripod, should be adjusted to a height sufficient to give a good, clear view of the top of the stove, so that you can distinguish the lids clearly, but no more.

261. **Preparing the Stove to be Photographed.**—A light canvas background should be used, in order to show the open-work and give a good outline for blocking out purposes. Where the trimmings are nicked the highly

polished parts are very apt to appear spotty. To overcome this, the polished or nicked parts are dulled with putty. Work the putty up with the hands, if necessary, softening it with linseed oil. When it is soft, but not tacky, roll it over the polished parts, which will give them a uniformly light, dull surface. Should the putty be too sticky when first prepared, mix a little powdered chalk with it, which will place it in good condition for use.

262. **Focusing and Exposure.**—Focus with the lens wide open and when you have obtained a general focus throughout, stop down until all parts are perfectly sharp. This will require considerable stopping down. This accomplished, make the exposure, giving full time—the color of the object being photographed requiring this. The amount of exposure is governed entirely by the strength of light employed and the size stop used. There being considerable latitude in exposure for this class of work, owing to the color of the object being photographed, it is better to aim at over than under-exposure, for any reasonable amount of over-exposure is very easily controlled in the development of the plate. Usually, with a U. S. 32 stop and fair light conditions, using an ordinary rapid plate, from 2 to 5 minutes exposure will be required.

263. Complete detail is always required; hence the shadows must be fully timed, but with slight over-timing of the high-lights you subdue the contrast and by careful development—for which the *Universal Developing Formula* given in Volume II is recommended—you will produce good results.

CHAPTER XI.

Photographing Pianos for Catalogs, Etc.

264. The enormous extent of the piano industry is barely realized by the average person, but it is safe to say that there is no city of any size in the country which does not boast of one or two piano factories, while every large department store has its own brands of pianos, known in the trade as "stencil pianos." Each and every one of these concerns publishes, usually annually, more or less elaborate catalogs and price-lists, for which photographs of all the various styles are needed. The advertising of pianos, too, which is more extensive than that of any other commodity, requires a large assortment of photographs of pianos and piano parts. Thus it is clear that the commercial photographer has here a large field in which to exercise his talents.

265. **Pictures Usually Made in the Factory.**—The size and weight of pianos entirely precludes the possibility of taking the instruments into the work-shops of the commercial photographer, many of whom have specially fitted skylights for furniture and similar objects. Consequently, the photographer has generally to do his work within the confines of the factory, and under more or less serious difficulties. Not the least of these is the lack of room or distance at which one can place the camera from the object.

266. **Wide-Angle Lens Not Advisable.**—The use of a wide-angle lens is usually not to be considered, as the perspective produced by such a lens is not pleasing in a catalog or advertising illustration.

267. **Going Over the Ground.**—The best plan, when called upon to do work in a factory, is to first visit the factory or shop and note the position of the windows in the room which has to be used, whether facing north or west,

etc.; also the size of the room, so that the needed focal-length of lens can be estimated; also the possibilities of working without interfering with the workmen. Usually the pictures must be made in the assembling-room, or polishing-room, both, as a rule, well lighted, but crowded with instruments and workmen.

268. **Best Time to Work.**—If possible select the noon hour for the work. At that hour, the men are out of the building and the machinery shut down, so that vibration and interference need not be reckoned with. All pianos being on easy running castors, no outside help is needed to move the instruments about to the required position.

269. **Locating the Piano.**—The pianos should be placed well back from the light, with the camera at a slight angle. As a general rule the photograph of a piano should show one end of the piano case and the full front. In other words, not quite a front view. (See Illustration No. 58.) The key-board should be left open and the music-rest drawn out. With the lens wide open, focus on the name-plate over the key-board and then stop down until both the near and the far end of the piano are in absolute definition. In all cases use a long-focus lens, so as to get as perfect drawing as possible.

270. The background material is of no consequence, as the negative is blocked out, yet a light canvas ground will aid in supplying a clear outline for tracing when blocking the negative. The level of the camera should be just above the key-board, as the top is not generally shown. The light being usually none too good, great care must be taken, during focusing, to observe that the end of the nearest leg or extended base of the piano is not cut off by the edge of the plate.

271. **Avoiding Reflections.**—Where the piano has already been polished it is a good plan to extend over the front of the camera a black cloth, with an opening for the lens, thus cutting out the reflection of the camera and tripod. The photographer should stand at some distance from the camera during the exposure, to avoid reflections

of his image on the piano. If reflections are cast on the lower part of the piano from the floor, spread a breadth of black calico on the floor in front of the piano, or place the piano on a dark rug.

272. Also, when it is desired to have the photograph of the piano as free from reflections as possible, to cut down the expense of the engraver, or where photographs are desired entirely without reflections, this may be accomplished by placing a screen of black calico, arranged wedge shape, on each side of the piano. The screen should not be placed too close to the piano, but close enough to cut out all side reflections, thus enabling all the light to fall broadly on the front.

273. Whenever possible, persuade the manufacturer to assemble the parts of his sample piano *before* polishing. Then, the original grain of the wood can be preserved and reflections will be eliminated, making the picture much more satisfactory.

274. **Brightening Dull Metal Parts.**—When photographing interiors of pianos or other musical instruments, to show the working parts, it is often advisable to rub chalk on dull parts of the mechanism, thumb-screws, etc., which are required to show up prominently.

275. **Exposure.**—The exposure for such work will naturally be a long one, usually ranging from five to twenty minutes.

276. **Development.**—The plates should be developed with a diluted developer, to which a few drops of bromide have been added. The bromide will prevent fog and the diluted developer will supply good detail. The *Universal Developing Formula*, given in Volume II, slightly diluted will produce excellent results.



Illustration No. 58
Commercial Photograph—Piano
See Paragraph 269



Illustration No. 59
Commercial Photograph—Bed
See Paragraph 280

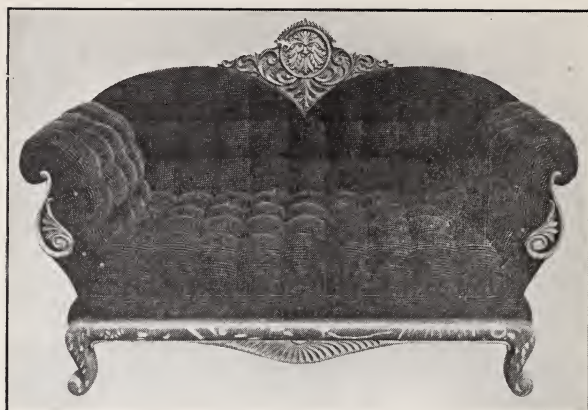


Illustration No. 59a
Commercial Photograph—Settee
See Paragraph 280



Illustration No. 60
Commercial Photograph—Table
See Paragraph 281

CHAPTER XII.

Photographing Furniture.

277. **Introduction.**—The manufacturers of furniture, especially when there is no upholstering, such as in beds, dressers, wooden chairs, etc., never finish or polish the wood for their sample pieces, before photographing, but only fill them with one coat of filler. This brings out the grain of the wood and gives an even surface throughout.

278. Furniture and highly polished surfaces are hard to photograph satisfactorily without the proper facilities. A soft diffused front light is necessary, and the light should come all from one source. If objectionable high-lights cannot be prevented, arrange to have them come from one source of light only. When this class of work is photographed in the studio you will usually require some white muslin diffusing screens on the skylight to diffuse the light in some portions. Where the work is done at the factory, the light from the windows may need to be diffused by means of cheese-cloth stretched across a portion of them. Under any circumstances a uniformly *soft* illumination must be given the object.

279. **Reflectors for Very Difficult Work.**—Many times a reflector must be employed to reflect light into weak parts. For this purpose a large mirror will be found very convenient. Where a mirror is not at hand a large white cardboard held in the hand, tilted to the proper angle, will answer the purpose. For articles of furniture requiring a perspective view, the front and one end must face the light, and in that case the camera worked more diagonally across the room.

280. **Lens to Use.**—A good rectilinear or an anastigmat lens should be used. Where distance will permit, a

very long focus lens is preferred. For example, where an 8 x 10 negative is desired, an 11 x 14 lens is best to use. With the larger lens better perspective will be obtained. The photographs for Illustrations Nos. 59 and 59a were made on 8 x 10 plates, with an 11 x 14 rectilinear lens. Short-focus lenses cannot be used successfully for photographing furniture, bric-a-brac, glassware, etc., as you will be troubled with distortion. When photographing tables, chairs, beds, stoves, etc., where a short-focus lens is used, the rear legs will appear very short and out of proportion. Even with a rectilinear lens of normal focal-length, one that can be used on a plate no larger than the size negative you are making, you will not get the best results. You should use a lens made for at least a one-size larger plate than the negative you expect to make; two-sizes larger, in many instances, would be still better.

281. To further illustrate the advantage of large-size lenses being used for this work, make a 5 x 7 negative of an ordinary table, using a 5 x 7 lens. Then attach an 8 x 10 lens to the 5 x 7 camera, or if the bellows is not long enough in your 5 x 7 camera to admit of the 8 x 10 lens being used, then attach the 8 x 10 lens to your 8 x 10 camera and use only a 5 x 7 plate, and make a negative of the same table with the larger size lens. Develop the two plates and note the difference; the one will show a very much distorted table similar to Illustration No. 60; the other will look well balanced, with good lines.

282. **Plates to Use.**—The best plate to use for this work is a slow one. With a slow plate and a long exposure the best of results can be obtained. The Commercial Orthochromatic plate will also be found to give good results, but the ordinary rapid plate is not good for this class of work.

283. **Exposure.**—As the lens is considerably stopped down to obtain detail and bring out the grain of the wood clearly, a long exposure is necessary—usually from two to four minutes being required.

284. **Development.**—All such work should be started developing in old developer and carried in this to a stage

where the grain is clear and snappy. Then a normal developer with a few drops of bromide added should be used to conclude the development. The old developer gives you snap and the fresh normal developer gives you softness and mellowness, which are essential for this class of work. The *Universal Developing Formula* given in Volume II is recommended for this work, always starting, of course, with old developer. In case of serious over-exposure, develop farther and then, after fixing, reduce with red prussiate reducer. See Volume II.

285. Finishing Commercial Prints.—While considerable commercial work is printed on glossy gelatin printing-out paper, and for some purposes it is the best to use, yet for the majority of the best work Aristo Platino or matte surface papers are preferred, and for cheap commercial work the gaslight papers are used quite extensively. For methods of manipulating different papers, see Volume IV.

286. Mounting and Finishing.—Where glossy gelatin prints are desired, they should be toned to a deep-brown or purple tone, and mounted on either canvas or paper backing. Where matte papers are used, the commercial backing paper supplied by the manufacturers is used almost exclusively.

287. Squeegeeing the Prints.—After the prints are thoroughly washed they are squeegeed on to ferrotype plates, the plates being first cleaned by washing with a soft sponge. Place the wet print onto the plate, face side down; with a flat 6-inch squeegee, swab off all surplus water; then place over the print a dry blotter and roll down with the print-roller, until all air-bells are expelled. In large establishments, where much work is to be done, a nickel-plated metal roller, 4 to 5 inches thick and about 24 inches long, may be used. A smooth metal bed the size of the squeegee plates used, which is also nickel-plated, is used to roll the prints on. One rolling over the prints with this roller is sure to expel all air-bells, thus saving considerable time and labor.

288. **Backing the Prints.**—When muslin backing is used, the back of the print on the tin plate is pasted, and the muslin backing adjusted to the print and then rolled in contact by a print-roller. Where paper backing is used the backing is first soaked in clear water to make it limp, after which the water is drained off and with the print pasted on the plate the backing paper is adjusted to the print, coated side up, and rubbed in contact by the print-roller. It is a good plan to put the cut pieces of backing paper and the prints in the final wash water at the same time. This insures the same expansion of both prints and backing paper.

289. **Combination Prints.**—There are times when prints are wanted mounted in sets of from three to six in a row, and in order to mount them so that they may be folded together, a squeegee plate as long as the combination required, is necessary. These large plates are made to order only, and can be purchased from any photographic supply house. To mount the combinations, first clean the plate well and, having previously sorted the prints and numbered them in regular order as they are to appear in the set, lay them within a quarter inch of each other on the plate, squarely adjusting them upon it in a straight line. Expel the surplus water with the flat squeegee and then roll them in contact with the print-roller or the large metal roller. With this done, paste the entire set; then cut narrow strips of muslin, about one inch wide and a little longer than the width of the print, and lay them over the joints of the prints, after which paste the strips and then back the prints with the regular backing and stand the plate up to dry. When dry, the print can be peeled off the plate by catching hold of one corner and gradually lifting on the print.

290. **Paraffining the Plate.**—Should the prints stick to the plate, the latter should be prepared with paraffine, which will overcome this difficulty. First wash the plates with warm water, carefully removing all the paste; then mop off with blotters and allow to dry. When thoroughly

dry, with a tuft of cotton swab the plate with the following solution:

Benzine 1 oz.

Paraffine 10 grs.

In the absence of the above solution a drop or two of castor oil may be substituted. It should be well rubbed in with absorbent cotton, and the plate then rinsed with clean water.

291. The plate is thoroughly swabbed with this solution and then polished with a tuft of dry cotton, rubbing all the superfluous solution from the surface, making it perfectly smooth and clean, when the plate is again ready for more prints. Plates should be polished with the above solution after using half a dozen times, to insure the prints not sticking.

292. **Trimming Prints.**—After the prints come from the plates they should be trimmed and squared accurately. This can be done either with the regular trimming board or by means of a sharp knife, using an ordinary metal square for a guide. After prints are squared, if they are to be used loose, all the corners should be rounded. This is done with a pair of large shears. Where the prints are to be used as leaves in a book only the two outside corners should be rounded.

CHAPTER XIII.

Photographing Laces, Cut-Glass, Silver Trophies, Bric-a-Brac, etc.

293. Certain difficulties present themselves in photographing small objects which do not make themselves apparent in the photographing of large objects, such as furniture. Aside from the manufacturers who need good photographs of their products for catalog illustrating, magazines devoted to fashions depend, to a great extent, upon the commercial photographer for illustrations of lace patterns, embroideries, and all kinds of lace-work. The instruction which follows, as to the methods to employ, will prove of material assistance in overcoming reflections, etc., in silver and glassware and the obtaining of pleasing results with lace-work and other fabrics.

294. **Camera and Lens.**—Any ordinary view camera, 5 x 7 or larger in size, is suitable for this class of work. A rigid tripod should, however, form a part of the outfit, for frequently prolonged exposures are given, especially where colored embroidery work is being photographed, which requires a color screen over the lens. The ordinary rapid rectilinear lens will suffice for this class of work and the rough focusing accomplished with the lens wide open. In making the exposure the lens should be stopped down to at least U. S. 32. No harm will be done in using even a smaller aperture, for the smaller the diaphragm opening the finer the definition.

295. **Lighting Laces and Embroidery.**—There are various ways of lighting these objects. In the majority of cases, however, it will be found necessary to use the light coming from one direction, or from one source, but where possible it is advisable to have the light fall on the subject

broadly, but not harshly, so as to give soft, even illumination throughout. In the studio the object may be arranged almost opposite the source of illumination, cutting off all of the lower portion of the light with opaque curtains, and using all top light on the object. In the home, where there are two windows on one side of the room, the camera may be set between these, with the subject directly opposite. If the room has a window in each of two adjoining walls, then the camera should be arranged in the corner of the room between these two windows, with the subject arranged near the center of the room directly opposite, thus permitting of a broad and even illumination.

296. It is not necessary to have the light diffused to any great degree; in fact, it is desirable to have strong but not harsh illumination. The relief or detail in the lace is produced by little catch-lights on the heavier portions of the design of the lace, followed by minute shadows on the outline. To obtain this relief the light must fall on the lace at a slight angle, yet the object must be evenly illuminated. Therefore, when working in the studio, by using all top light you obtain this result. Where two ordinary windows are employed the desired effect may be produced by cutting off the illumination from one window during a portion of the exposure. A very even illumination should be given during the first half of the exposure by using both windows, after which, by lowering the opaque curtains on one window, the light is shut off from this source, and the remaining illumination, coming from the other window, supplies a sufficiently even illumination, also a correct angle of light upon the object, which creates catch-lights with enough shadow to cause the lace to stand out in bold relief, resulting in snap and roundness in the photograph.

297 **Background.**—For white or cream-colored laces a black background should be employed. This may be of black velvet, or better still, common table oil-cloth (cloth side out), stretched over a drawing-board, the cloth side being painted with two coats of dead black shellac.

298. **Placing Lace on Board.**—Lay the lace on the center of the board, and smooth out wrinkles and snags carefully with a bristle brush. Stick common black pins through the selvedge edge of the lace; the pins must be inserted at right-angles to the board. After the pins have been inserted in position the heads may be clipped off. When all of the pins are in place set the board upright in position. Now, with a long hat pin, very carefully pull the lace out from the background until it hangs on the very tips of the pins. This destroys all evidence of the grain of the background and gives more depth to the print. (See Illustration No. 60a.)

299. **Photographing Delicate Laces.**—Where extremely delicate laces are to be photographed it may be found impossible to place them in an upright position. Should such be the case, the drawing-board background may be laid flat on the floor, and by employing a tilting tripod top the camera can be pointed downward. By adopting this method of procedure it will not be necessary to use pins, but the lace must be very carefully smoothed out—using the bristle brush. When working with the lace arranged on the floor, a splendid lighting effect may be obtained about four feet from an ordinary window. The illumination will be diffused and broad, yet the angle of light will supply snappy catch-lights with sufficient shadows to give depth to the picture.

300. **Plate to Use.**—The effect required is delicate half-tones, with predominating catch-lights contrasted with a dead black background, therefore, for the best results a slow plate should be employed, yet with care an ordinary rapid plate may be used successfully. If colored embroideries are being photographed, orthochromatic or panchromatic plates, with a three or four-times screen, should be used to render correct color values.

301. **Developer.**—Any normal pyro developer diluted one-third with water will give good results. A metol-hydroquinon, with very little of the hydroquinon, will also prove very satisfactory. The finest results, however, may

be obtained by long exposure and special development, as instructed in Volume II.

302. **Glassware.**—Roundness, transparency and detail as well as the avoidance of reflections are the main points to consider when photographing glassware. In nearly all cases the background employed is black, yet some very effective results may be obtained by using a white background for making the negative, and then by contact make a transparency from the negative and print from the transparency. With the white background for making the negative you produce a black background in the finished print from the transparency, with snappy catch-lights and clear detail in the subject. Therefore, the nature of the background is not of great importance, but the greatest amount of care should be exercised that the object be so lighted as to give roundness and snap in the finished results.

303. **Lighting.**—Unless proper precautions are taken difficulties will be experienced when photographing glassware, cut-glass, etc., in overcoming reflections and excessively strong high-lights. The subject should be lighted a trifle from the side. An ordinary window supplies good illumination for this purpose, working with the object about four feet away from the window and a little to the rear of it, and the camera arranged as close to the wall or window as possible.

304. **Frame to Avoid Reflections.**—To avoid side reflections a small three-sided frame may be employed. This frame can be easily constructed by taking three sheets of cardboard 22 x 28 inches in size, having a dead black surface on one side. Lay the three cards, with the black side up, edge to edge on the floor or work-bench. Paste strips of dark cloth over the adjoining edges—these act as hinges. When dry the frame is ready for use. Place this cardboard frame on the table or support which is to hold the subject, with the black side facing inward, the whole forming a U-shaped enclosure. The subject should now be placed in the center of this enclosure. In other words, the subject will be about eight inches from the background,

and the cardboard wings on each side will extend sufficiently to the front to cut off all side reflections in the glassware. The frame may be constructed of boards, if desired, and then covered with velvet or plush, or any black material which will absorb, rather than reflect, light.

305. When small articles, such as cut-glass, tumblers, small vases and small silver pieces are to be photographed, very good results may be obtained by placing a black cardboard, about 14 x 17 inches, against an ordinary window, and then place the article on a table within, say, six inches of the cardboard. Then place the camera directly facing the window. The object will receive illumination from both sides, thus giving prominence to the figure or design. For small articles the camera should be arranged to slightly look down upon them. For tall articles this would not be satisfactory, as the article would appear distorted, and a more central point should be selected.

306. When photographing toward the light the lens must be shielded from the strong rays of light; otherwise the light shining in the lens will give you a fogged plate.

307. **Coins, Jewels and Flat Surfaced Objects.**—Photographs of coins, jewels, engraved plates and flat surfaced objects, generally, are best made arranged on the floor, with the camera attached to the tilting tripod attachment. By arranging such articles on the floor, using an ordinary window for the source of illumination, you will have sufficient cross light to give snap, and at the same time the light is sufficiently broad and soft to give good detail.

308. **Another Method for Avoiding Reflections.**—French chalk or putty (rolled up into a ball) applied to silver objects will produce a dullness which will prevent reflections. If French chalk is employed, it will be a good plan to make a bag of some soft material, in which to place the chalk. Then the bag containing the chalk is patted over the subject, leaving a coating of powder. One of the best methods to employ, however, but one requiring quick action, is, after having focused the subject and gotten everything in readiness for the exposure, to place a piece of ice in the

glass, china or silver object, if it is an open receptacle. As soon as the subject is thoroughly chilled it will be covered with a fine moisture, which gives the same effect as the powder or putty. The exposure must be made at this moment; otherwise the accumulation of the moisture will cause water to run on the surface, leaving streaks, which will appear in the picture.

309. **Silverware, Trophies, Etc.**—Silver trophies, coffee services, and similar subjects, may be handled in the same manner as already described for glass and chinaware. Careful attention, however, must be given to the arrangement of such subjects, and when photographing silver trophies where there is any lettering, dedication, or other engraving, this should, of course, be brought prominently to the front. With the light coming from one side the lettering or engraving will show clearly. Silverware is best photographed against a black velvet ground. In the case of a cup or trophy, a block or plinth covered with black velvet cloth should be used on which to support the object.

310. **Plates.**—For photographing ornamental or painted china, a slow orthochromatic plate, together with a four-times screen, should be employed, so as to give a correct rendering of the color values. For objects of one color the ordinary plate will answer—preferably a slow plate with long exposure.

311. **Development.**—Development should be carried to a point where all detail is full and soft. The little high-lights which appear on cut-glass or down the side of a vase should show clear and strong, as these high-lights are essential to give the necessary roundness. The formula and instruction for *special exposure* and *development* given in Volume II is particularly recommended for this class of work.

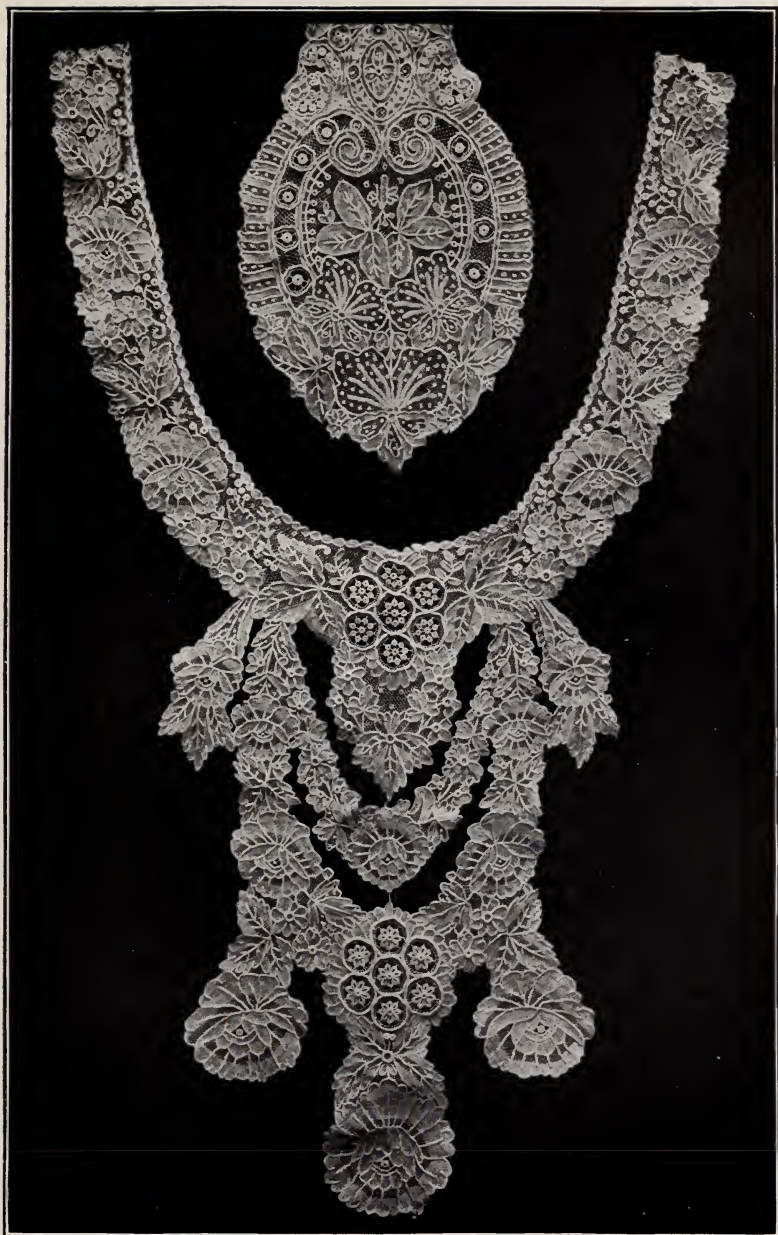


Photo by Harry C. Peterson, Palo Alto, Cal.
Illustration No. 60 *a*
Example of Lace Photography
See Paragraph 298



Illustration No. 61
 Catalog Illustration
 Continuous Background (Vignetted Cut)
 See Paragraph 316



Illustration No. 62
 Catalog Illustration
 Continuous Background (Plain Photograph)
 See Paragraph 316

CHAPTER XIV.

Catalog Illustrating.

312. A very important use to which photography has been put is catalog illustrating. There is scarcely an article advertised that is not photographed and the illustration employed in advertising literature. Various machines and office appliances, and almost all manufactured articles, are photographed so as to show their exact appearance, and in the case of instruments and machinery, they are photographed in sections, illustrating the mechanism and manipulation.

313. Photographs for this purpose require clear, sharp detail, with uniform illumination over the entire object. The matter of background or foreground, as a rule, for this class of work is of no consequence, as the object is usually blocked out on the negative before the prints are made; or, in many cases, prints are supplied to the engraver direct from the negative without blocking, when the artist employed in the engraving establishment will paint over the print, blocking out all objectionable parts, building up and strengthening the outlines, weak parts, etc. So the photographer's work is merely the producing of the best direct photograph possible, so that the engraver has a good basis on which to work.

314. **The Lens.**—The best lens to use for this class of work is one of fairly long focus. The focal-length of the lens should be at least twice the longest side of the plate. This will permit of the camera being placed far enough away from the subject to give accurate perspective. A wide-angle lens should never be used unless it becomes necessary owing to working in confined quarters, where the object is immovable. A wide-angle lens will not give a

true rendering of the object; it invariably gives a flat and distorted image, the front of the object being decidedly out of proportion to the rear. The ordinary rapid rectilinear lens, or an anastigmat lens, may be used very satisfactorily. Both, however, should be stopped to at least *f.* 16, in order to secure good depth of focus. If the distance from the front of the subject to the rear is considerable, and the camera is quite close to the subject, a smaller aperture will have to be employed, to be sure that all parts are absolutely sharp.

315. **Background.**—As a rule, the background for the majority of articles should be perfectly white. When articles are arranged on a table or similar support for photographing, a drapery of some neutral tint may be employed, covering the table and extending back of it to a height sufficient to give a background for the articles being photographed. It matters but little what the material is which you use for a background, as all the space surrounding the object is usually blocked out in the negative, but canvas or muslin is usually employed. Where the background is admitted as a part of the picture, then such goods should be employed as are in keeping with the articles being photographed. Generally some soft, plain drapery of a neutral tint is used.

316. **Continuous Background.**—When photographing small articles requiring a continuous background, a sheet of cream wrapping-paper may be used, laid over the back of a chair and across the top of a table, with a curve in the paper as it extends from the table to the chair, thus avoiding any dividing line between the background and the base upon which the object is arranged. An example of this work is shown in Illustration No. 62. In Illustration No. 61 is shown the same picture which has been worked up by the engraver's artist ready for the catalog, showing the outline to the best advantage. It also shows the manner in which the engraver has vignetted the cut, giving the picture a neater appearance.

317. **Hand-Work.**—Although it is customary to have hand-work on illustrations of this character done by artists

employed by the engravers, yet if the photographer knows how to do it, he has an opportunity of adding many extra dollars to his bank account. In doing this work the photographer has an advantage over the artist, for considerable of the building up, strengthening and outlining can be done on the negative itself. There are some parts of the work, of course, that will need to be made on the print, such as the blending, etc., which is usually done with the air-brush. When background designs are changed, the work is done on the print, but the general outlining and accentuating, evening up of tones, etc., can be done on the negative.

318. All white lines on the object should appear white in the finished print. Outlines of the object, where they contrast against black, should be white. Portions contrasting against white should be black. This is clearly shown in Illustrations Nos. 63 and 64. In Illustration No. 64 is shown a picture of a Multigraph machine, the print being made direct from the negative, unaltered. In No. 63 is shown a reproduction from the same negative after the hand-work had been applied.

319. The first work to be done is to locally reduce the strong lights, giving them a more uniform tone and obtaining all detail possible in all parts of the negative. Then the entire machine is blocked out, giving a pure white background, after which a print is made from the negative and mounted on a piece of smooth cardboard. After the print becomes dry, it is worked up and strengthened. The first work to be done is the strengthening of the outlines. In Illustration No. 63 we began by strengthening the edge of the plate running across the top of the machine. This we outlined with a draftsman's ruling pen. The rubber pad, on which the machine rests, is also outlined in black.

320. Bright portions of machines and all metallic parts of objects throw reflected light, which latter is often objectionable in photographs, and they must be softened in the print if they were not properly treated on the original. The air-brush is the most satisfactory accessory to employ in accomplishing this result. These bright surfaces

are sprayed with a fine spray of ink, thus giving them an even surface. Shadows in the sheets of paper used as a background are also softened with the air-brush. All such parts are sprayed over rather promiscuously but evenly, and finally delicate high-lights are cut out by erasing the ink with a rubber eraser. The nicked parts are strengthened by slightly outlining the high-lights with Chinese white.

321. The most important point to remember is, that all outlines and distinct parts or features must be perfectly clear and show exactly what they are. The lettering must be sharp, for it is extremely important that they be clearly reproduced. Black letters are best worked up in the final print, while white ones, although they may also be accentuated with white ink in a similar manner, should be chalked up on the object itself before the exposure is made.

322. If any parts of an object reflect too much light they may be easily dulled by rubbing a little putty over them. By properly applying putty and chalk to the original object, and by giving careful attention to the lighting, very little hand-work will be required on the final print, other than to outline the important parts and to accentuate straight white lines on the object itself.

323. A regular draftsman's ruling pen, which may be obtained at any artist's supply store, should be secured for making straight lines. The liquid water-proof India ink and a liquid Chinese white ink (Letterine), should both be procured, as they are the best for use with the ruling pen.

324. A right-angled triangle made of celluloid (also procurable at any stationary store), should be used as a guide for the pen. On account of its transparency it is possible to see through this triangle, which enables one to observe what is directly underneath. In this way the whole of the picture is unobstructed and no errors are likely to be made, which would be often the case if an opaque rule were employed. An advantage of the ruling pen is, that the lines may be made any width desired by simply varying the distance between its two points by means of the

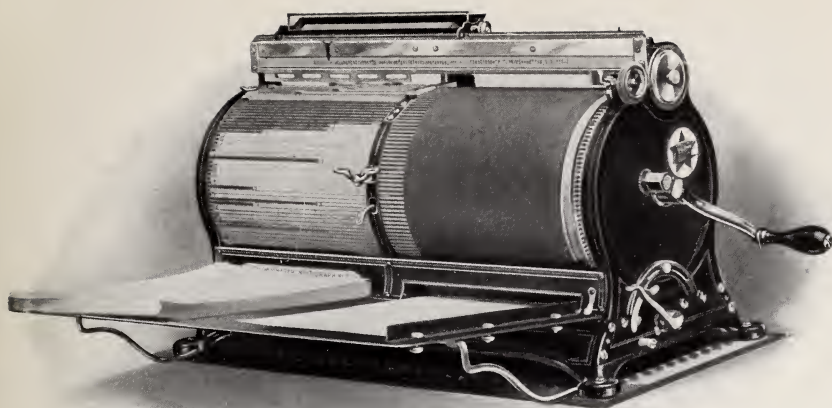


Illustration No. 63
Catalog Illustration (Vignetted Cut)
See Paragraph 318

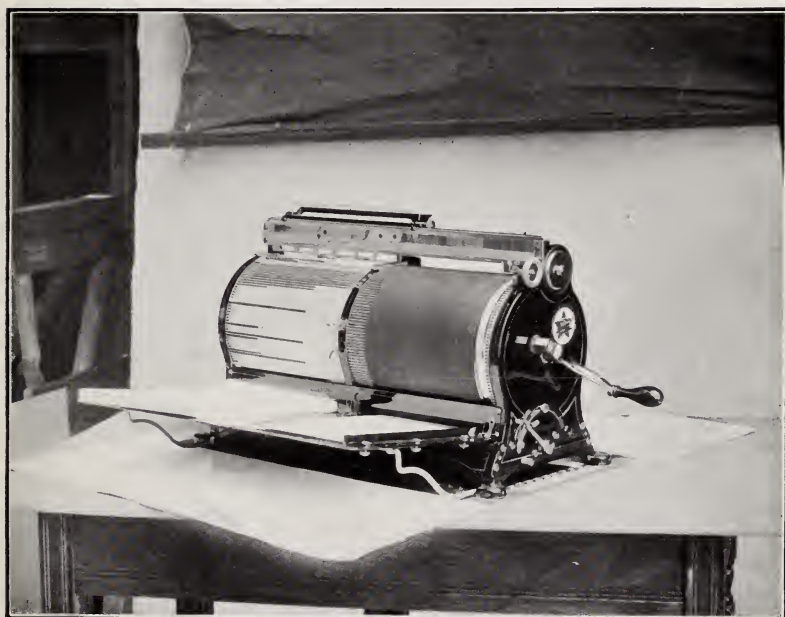


Illustration No. 64
Catalog Illustration (Plain Photograph)
See Paragraph 318

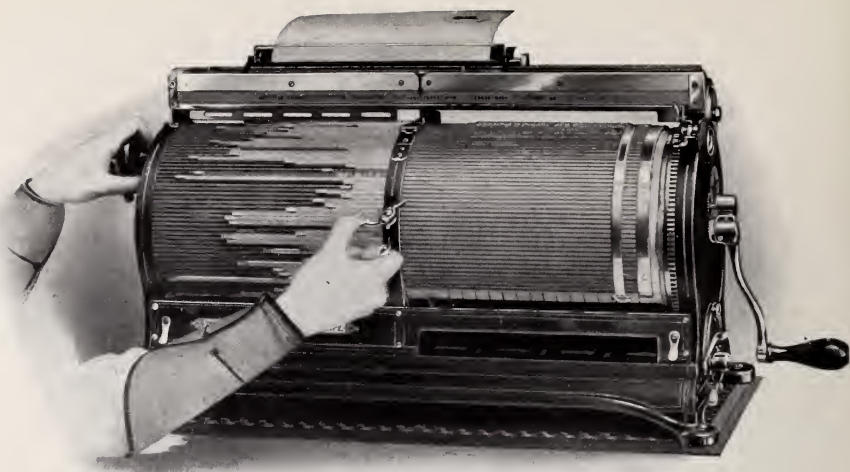


Illustration No. 65
Catalog Illustration (Vignetted Cut)
See Paragraph 327

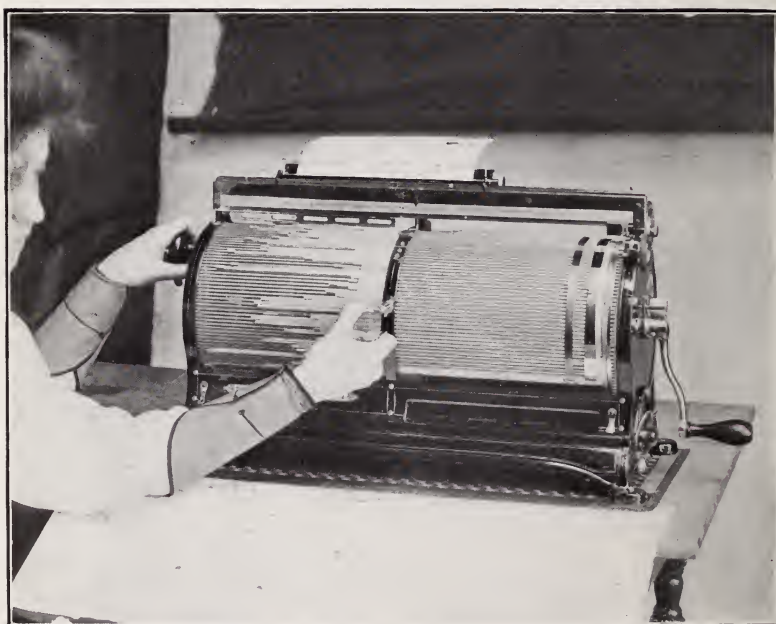


Illustration No. 66
Catalog Illustration (Plain Photograph)
See Paragraph 327

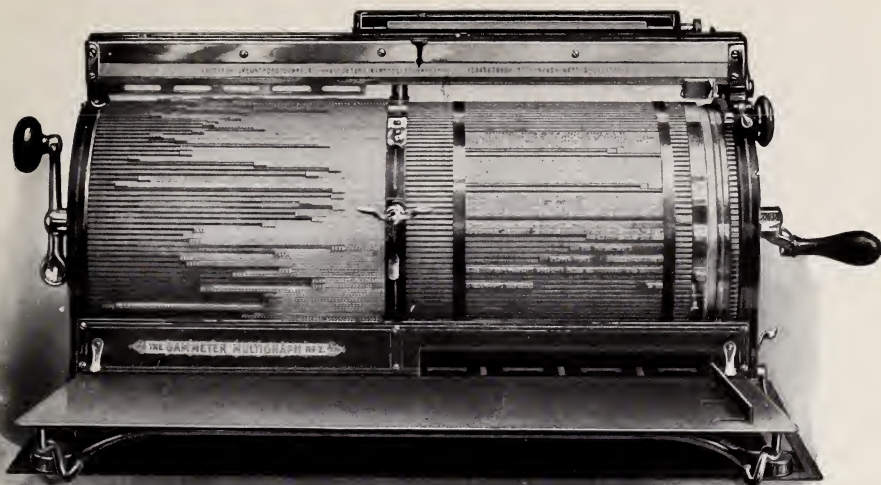


Illustration No. 67
 Catalog Illustration (Vignetted Cut)
 See Paragraph 327

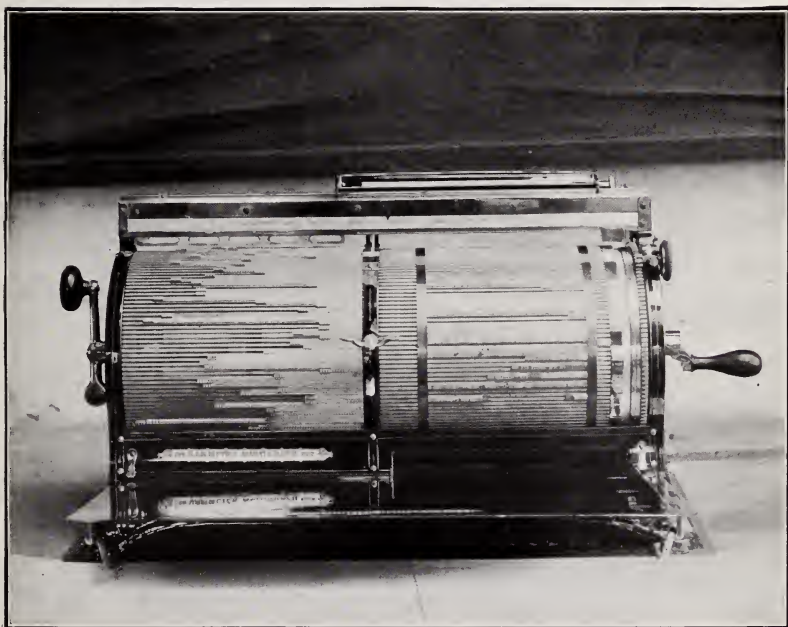


Illustration No. 68
 Catalog Illustration (Plain Photograph)
 See Paragraph 327

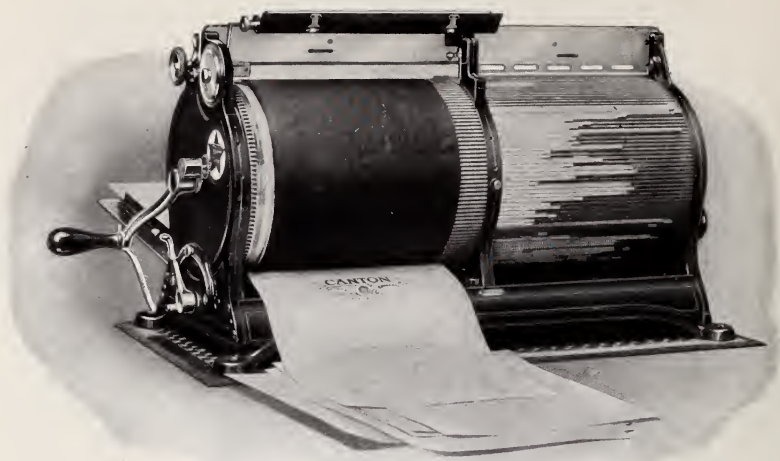


Illustration No. 69
 Catalog Illustration (Vignetted Cut)
 See Paragraph 327

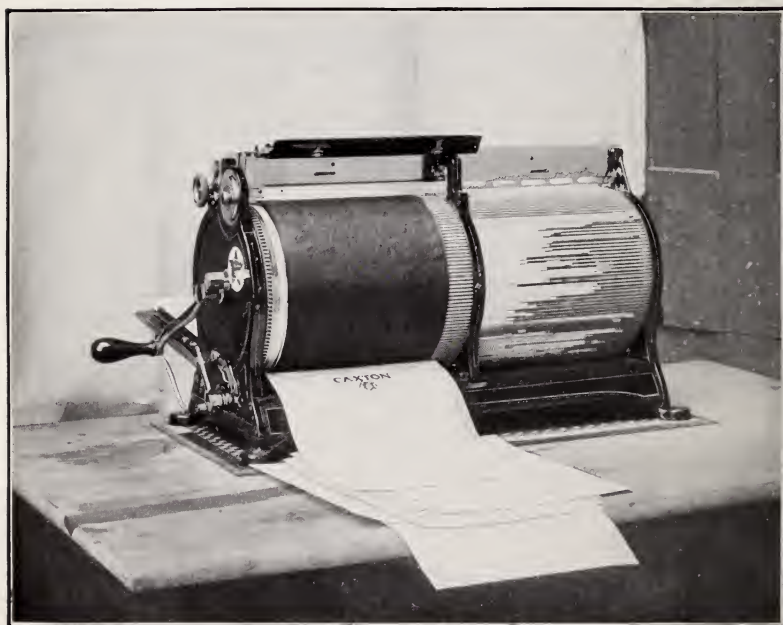


Illustration No. 70
 Catalog Illustration (Plain Photograph)
 See Paragraph 327

thumb-screw. The pen should always be held in a perfectly vertical position, in order that the edges of the lines may be smooth and not ragged.

325. **Size of Print.**—One should use large plates, if possible, for all commercial work, but if you do not desire to invest in an expensive outfit, you may use smaller plates and make enlargements from the small negatives, which can be very carefully worked up. Smooth bromide paper is the most satisfactory to employ for this purpose. Hand-work on large prints will not show in the final reproduction, providing the illustration is much smaller than the print. The reduction in size does away with any slight roughness which might appear in the large original.

326. To further illustrate the methods employed in making photographs for catalog work, we have chosen for our subject the Gammeter Multigraph, which instrument is used to print duplicate type-written letters. This machine, instead of printing a character at a time, as does the ordinary typewriter, prints the whole letter, and to illustrate the method of working as clearly as possible, the manufacturers of this machine have in their excellently printed catalog shown the various steps from the setting up of the type on the machine to the printing of the letters.

327. In the accompanying illustration we show reproductions from the original photograph, as well as from the final worked-up print, which latter illustrations were used in the catalog. Illustration No. 66 shows the picture of the machine as supplied by the photographer. Illustration No. 65 shows the hand-work applied to the print by the artist, to give it a more even and uniform tone. This illustration shows the method of setting up a letter, the type in the left-hand cylinder being thrown, letter by letter, into the right-hand cylinder by means of a key, which the lady is pressing down with her right-hand thumb. The cylinder on the left side is revolved by the left hand until the proper type character is opposite the channel which leads onto the printing drum constituting the right half of the machine. The form is held in position on the print-

ing drum, as shown in Illustrations No. 68 and No. 67. No. 68 shows the print as furnished by the photographer and No. 67 shows the results of the hand-work by the artist. No. 64 and No. 63 show the feeding of the machine for printing; No. 64 represents the print as received from the photographer and No. 63 the results after the print is worked by the artist. This illustration shows the operating of the machine. By turning the handle to the right the sheet of paper is drawn between the ribbon and a rubber platen, coming out on the opposite side of the machine, as shown in Illustrations Nos. 69 and 70, the latter representing the photographic print and the former the hand-worked print.

328. Carefully compare Illustrations No. 63 and No. 64 and notice how the upper portion of No. 63 has been blocked out, while the lower part has been vignettted. The object of placing the white paper on the table in front of the machine was to completely separate the machine from any support that might be considered a part of the machine, and also enable the engravers to vignette the cut more easily.

329. In Illustration No. 67 the objectionable reflections which occur on the little platform in front of the machine in Illustration No. 68 have been worked out, and the outline of the various parts ruled in white, so that they may be shown to their best advantage. By comparing these two illustrations you will see other portions which have been worked up with either the air-brush, white ink or India ink, the black being required in some places, while the white is used in others. By careful comparison of the different illustrations, you will observe the manner in which the prints have been worked up to produce the final results.

330. Another type of subject is presented in Illustrations Nos. 71 and 72. This picture illustrates the manner of photographing a gentleman's traveling outfit to be used for catalog work. In Illustration No. 72 is presented the straight print from the negative. Here, you will observe, an ordinary knock-down table was used, upon which the articles were arranged. A piece of white canvas was care-



Illustration No. 71
Catalog Illustration—Traveling Outfit (Wash Drawing)
See Paragraph 330

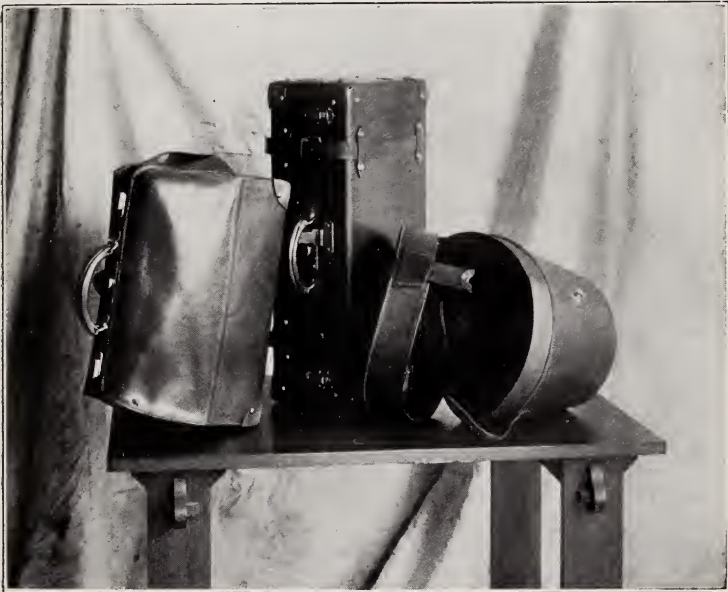


Illustration No. 72
Catalog Illustration—Traveling Outfit (Plain Photograph)
See Paragraph 330



Illustration No. 73
Catalog Illustration—Fashion Plate (Plain Photograph)
See Paragraph 332

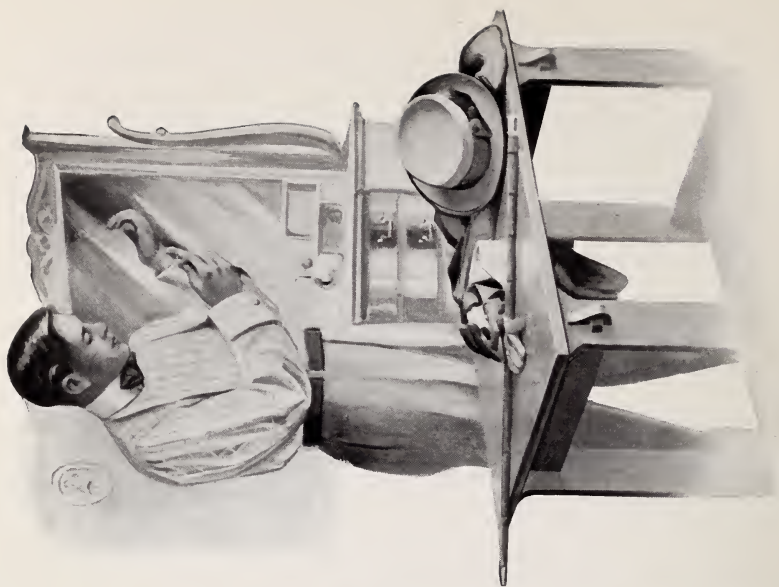


Illustration No. 74
Catalog Illustration—Fashion Plate (Wash Drawing)
See Paragraph 332

lessly hung behind the table, to act as a background. In Illustration No. 71 is presented a reproduction from the picture after the artist had applied his work. You will readily observe, by comparing these illustrations, that all the engraver requires is a print with good, clear detail and sharp outline. From this print he builds his final results, either by working directly upon the print, or, as was done in this case, by making a bromide enlargement and then applying the work upon the enlargement. All portions are carefully outlined and detail worked in where it was not sufficiently clear. The background, as you will observe, has been practically removed, and in the engraving the print has been vignettied, thus giving a clear outline to the picture.

331. **Wash Drawings.**—All wash drawings are usually made over bromide enlargements; therefore, all that is required from the photographer is to make a small negative showing the attitude of the subject and a suggestion of the object of the picture. In other words, the photographer originates the ideas and arranges his subject, supplying the foundation and model for the artist to follow. With this foundation the artist works up the picture, adds in the background and completes the work.

332. In Illustration No. 73 is shown a model posed for a fashion plate to be used in illustrating men's negligee garments. The subject, as will be observed, is arranged in the act of dressing, with all garments carelessly placed on the table before him. The picture was made by an ordinary window in a tailoring establishment, using a mission table as the only accessory in carrying out the idea, the background being a crude canvas affair which answers every purpose, as this will be all blocked out by the artist. This picture was made on a 5 x 7 plate and a straight print supplied the engraver, who in turn copied the picture and made a bromide enlargement from it about 11 x 14 inches in size, and after painting out the background, leaving a plain white surface, he worked in the additional accessory in the form of a dresser, and also strengthened the appearance of the objects on the table and worked over the table itself.

The figure was then built up, the shirt and trousers all modeled to neatness, the likeness of the face changed, etc., resulting in a splendid illustration to be used for the advertising of such goods. (See Illustration No. 74.)

333. **Business Places for Catalog Work.**—Ordinarily, the photographing of business places is a simple matter, yet, at times, the task is a difficult one, owing to obstructions before the building, such as telegraph poles, wires, etc., which become very annoying to the photographer. While these wires and poles are not objected to in the ordinary commercial print, yet, when the picture is desired for catalog work, they should be removed. This is more easily done when the picture is made on a large plate (not smaller than 11 x 14 inches) and glossy paper used for the print, toned to a brown color.

334. Where a large plate cannot be made, a bromide enlargement can be made from a small plate and the wires and poles painted out on the enlarged print. To paint out these objections a wash is prepared by mixing white ink or Chinese white, with India ink, so that the tint will exactly match those portions surrounding the parts to be removed. Then, by using a small brush the objectionable features are spotted out, after which the paint is allowed to dry; then, with a still finer brush, the detail in the structure is worked out over the painted out portions, thus removing all traces of the brush work. For example, in Illustrations No. 75 and No. 76 a bank building is shown before and after the pole and wires were removed. When removing the telephone pole it was necessary to use a tint which exactly matched the stone of the building, and when the pole was all taken out the detail of the building was worked in where the telephone pole had been. The wires were also worked out in a similar manner, requiring, of course, an extremely fine brush for this purpose. The lettering was accentuated with white ink applied with a very fine brush. In fact, all detail, and especially that in the fire escapes, has been slightly accentuated, and the half-tones vignetted so as to give a pleasing cut, as shown in Illustration No. 75.



Illustration No. 76
 Catalog Illustration—Bank Building (Plain Photograph)
 See Paragraph 334

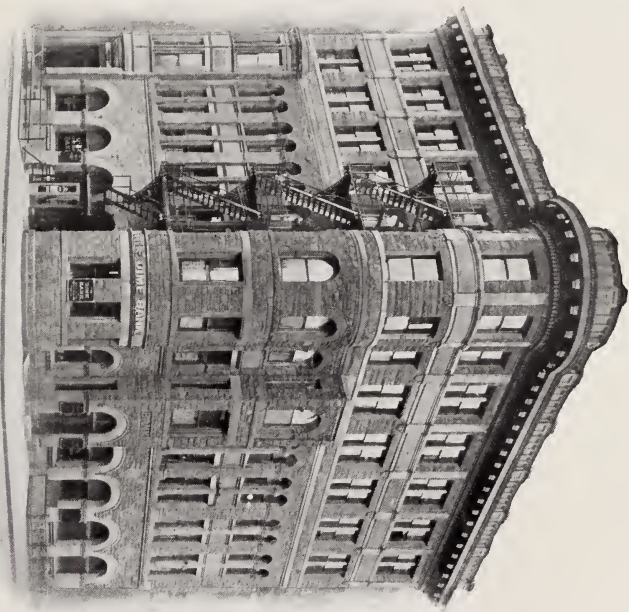


Illustration No. 75
 Catalog Illustration—Bank Building (Worked-Up Print)
 See Paragraph 334

22-13

PHOTO NEG. NO. 8549.

SIZE OF NEG.

SUBJECT

CUT NO.

DATE TAKEN

THIS CARD SHOULD BE FILED UNDER

GUIDE TITLE

SUBDIVISION

Boring Casting of Cylinder Exhaust End
(Top View) for 4000 H.P. Allis Chalmers
Steam Turbine. Taken at West Allis.

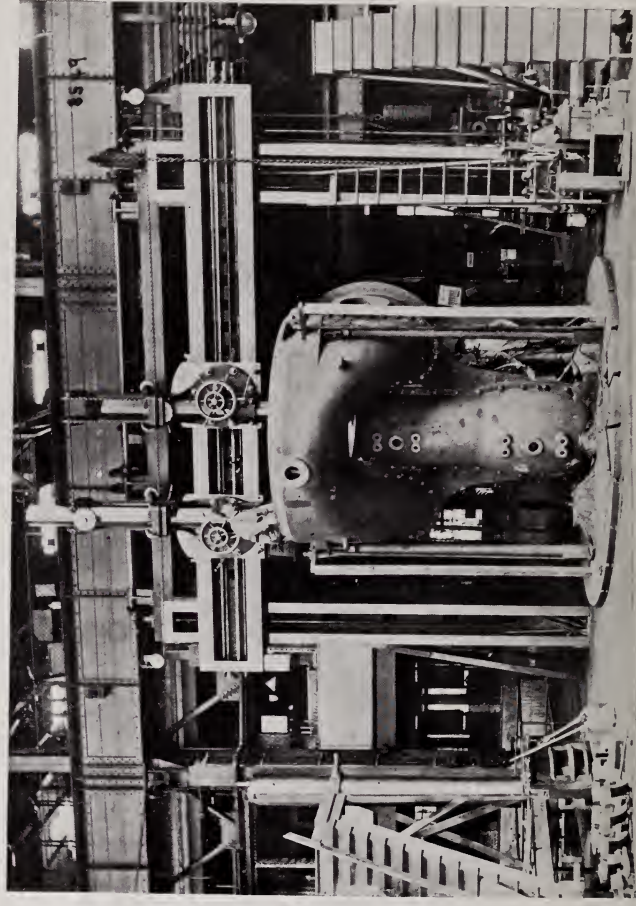


Illustration No. 78
Construction Work—Photographic File Card
See Paragraph 365
Courtesy of The System Co., Chicago

CHAPTER XV.

System for Handling Construction Work.

Part I.

Introduction.

By E. S. Hanson,* Editor "The Contractor."

335. A record of every important detail of business—a record that has a meaning and a use—that is one of the purposes of *system*.

336. Business today is developing a new kind of record—automatic, accurate, incontrovertible—the photograph. To manufacturers and builders, to engineers and contractors, who are carrying out the vast constructive enterprises of the day, the photograph is coming to be a most important record.

337. To these men, who are accustomed to handling reports, drawings, profiles and blue prints, from one end of the day to the other, it is a positive relief to have a superintendent send in with his report, a photograph of the work as it actually stands when the report is made. And then, too, it verifies the report. Even the superintendent with the best of intentions is likely, at times, when the work has dragged, to convey the idea in a written report that more has been done than is actually the case. A photograph cannot very readily be made even to imply an untruth. And if the superintendent knows that a photograph must be taken at a certain time, he will put forth his best efforts in order that it shall show as great an amount of progress as possible.

338. Large construction companies, such as the Arnold Company, of Chicago, on all their work make photo-

* Reproduced by permission of *The System Co., Chicago*.

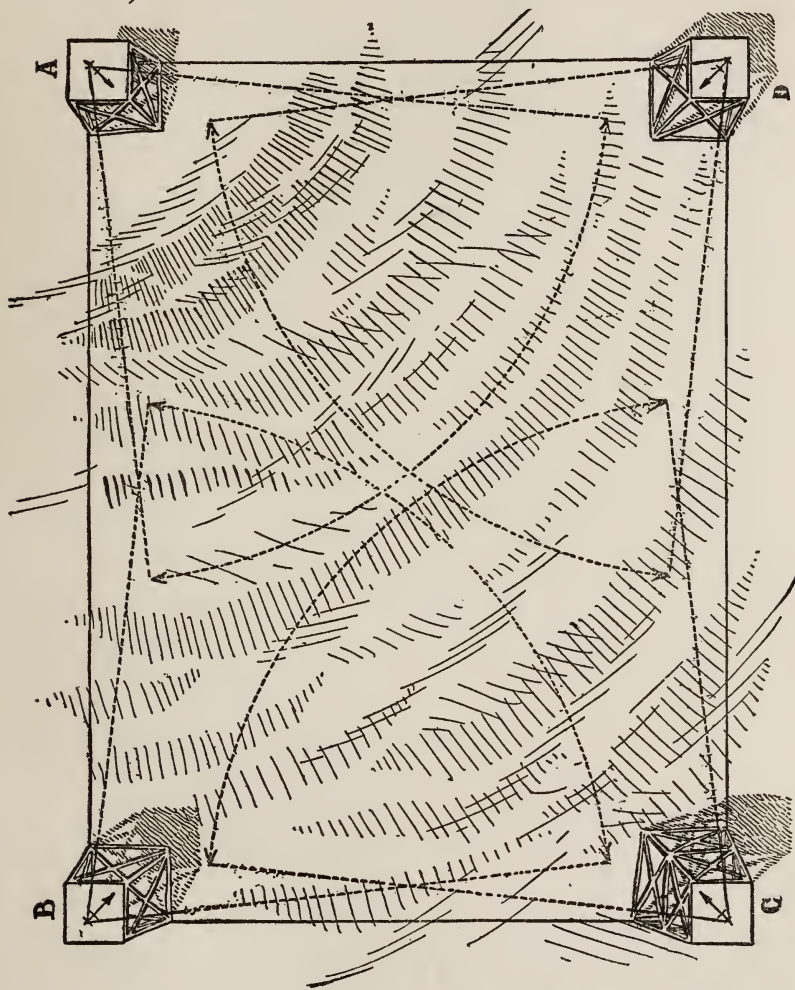
graphs at uniform intervals of two weeks. These are all made a uniform size of 8 x 10 inches, and with "progress blue prints" of the same size they are fastened with eyelets in a heavy paper cover. These covers have printed on the outside the name of the job, date, name of customer, and location. Several sets are made up for each date. The covers are printed in quantities, the printer changing the date for each set. One of these sets is kept in the files of the main office, and one set at the office on the work. One set is also sent to the person for whom the work is being executed, or to each of them if there are more than one. A few are kept on hand for emergency and to show to prospective clients.

339. **The Usual Method of Securing Photographs of Work.**—A contract is made with a local photographer in each place where work is to be prosecuted. This contract specifies the exact size of the plates and the prints, the color, the style of finish and mounting, the price for the plate, and the price for prints. The plates in all cases remain the property of the company, and the photographer is not allowed to sell copies without permission. This is readily granted in most cases, however, and brings an added income to the photographer; he is also allowed to place his imprint on the back of each photo.

340. Where photographs are 8 x 10 inches or larger, most contractors prefer to have them mounted on muslin, with a hinge and extension for binding. Sometimes this is done on the smaller sizes, though these are more frequently printed on ordinary paper and mounted in an album, such as can be secured of almost any dealer in photographic supplies.

341. One of the higher refinements of photographic work has been worked out by one of the engineers of the Arnold Company in connection with the construction of the shops of the St. Louis and San Francisco Railroad, at Springfield, Missouri. Here, instead of a hit-and-miss system of taking anything which seemed to be of value from any desired point, the company established four points on

the job from which all views are taken. (See Illustration No. 77.)



Courtesy of The System Co., Chicago

Illustration No. 77
Construction Work—Location of Towers—Ground Plan
See Paragraph 341

342. The ground on which the shops are being located is a rectangular piece about forty acres in extent, and has

a considerable diagonal slope. At each corner of the rectangle a substantial but inexpensive tower was erected, the four of varying heights above the surface of the ground, but all uniformly thirty feet above the grade on which the buildings were to be placed. The buildings were to be sixty feet high, so that a camera placed on any of the towers would cover the buildings without distortion.

343. Photographs Taken with the Accuracy of a Surveyor.—A point and an arrow of direction were established on each one of these towers. The photographer was required to adjust his camera to these each time an exposure was made, almost as accurately as a surveyor would adjust an instrument in striking a line. These stations are lettered A, B, C, D; the proper letter is put on the negative in connection with the serial number. These photographs, taken from the same identical points each time, enable one to see the building grow before his very eyes, almost like the film of a moving picture machine. In addition to the views taken from the towers, detail photographs were also made of important parts of the construction.

344. Uses of Photographs to the Contractor.—The uses of photographs other than their merely casual and incidental application, are stated by one constructing company as follows:

345. "For keeping office employees in touch with the varying conditions on the various jobs.

346. "For indisputable records of the condition of adjoining buildings before starting work, and after its completion.

347. "Photographing cracks over doors and windows and in other places to show whether or not any settlement has taken place, due to the construction work involved.

348. "For records to be available in case of a law suit or other discord or misunderstanding.

349. "For advertising purposes."

350. Methods of Procedure.—Various other rules, as follows, indicate the methods of procedure in photograph-

ing, which have been found to be most advantageous in obtaining the pictorial record desired:

351. "In all cases pictures should be taken of the men while at work, and not as though idle and posing for a picture. On out-of-town work, prints should be mailed to the home office, and the negatives expressed promptly to the regular photographer employed by the firm. All negatives should be dated and numbered. Prints should be unmounted, and gaslight paper should be used for all prints. The notation to be used on all photographs must include the proper contract number, the serial number and the date.

352. "Special stress is laid on the advisability of obtaining photographs of conditions at the time of any accident. Unless otherwise directed, at least one roll of films should be taken on each job, each week, and all pictures on that film should be taken the same day.

353. "After the film is removed and sealed, the contract number and date of taking photograph should be clearly written upon it."

354. **Value of Photographic Records.**—In its working application, the system of photographic records just described has been found, through its check upon the work of the employees, to prevent damage to owners, to adjoining property, and to the contractor's interests, and to prevent legal disputes, as well as furnishing the data necessary to settle them without delay.

355. **Classes of Photographs.**—Many engineers and contractors require two classes of photographs to be taken on all pieces of work: Construction photographs, which are kept for record of the method and progress of the work; and what may be termed "publicity photographs," kept for showing the class of work the firm is engaged in, thus influencing prospective clients, and for advertising purposes.

356. **Superintendents of Construction can Make the Photographs.**—Among firms following this method are Dodge & Day, of Philadelphia. Each of their superintendents of construction is provided with a film-camera taking a photograph 4x5 inches. At regular intervals photographs of

the work in progress are made, a placard giving name of client and date having been placed on the work. The film is returned to the home office, and two prints of each negative are made by the firm's photographic department. The films are kept on record in that department. Consecutive numbers are given to each plate, regardless of what job it comes from; each job is given a letter, which is prefixed to the number. One print is kept at the home office, and one print is sent to the superintendent on the work. The print in the office is properly filed under the letter and date, in a cover provided for that purpose.

357. Photographs Aid in Publicity and in Securing Business.—The publicity photographs are made 8 x 10 inches in size, by the firm's regular photographer, at such intervals during the course of work as will insure interesting pictures. These plates are given consecutive numbers and a blue-print of each plate is kept on permanent file in the home office.

358. Photographs as Evidence.—While the primary purpose of these photographs is to secure a record of progress and to supply material for publicity; they are valuable evidence in case of disputes; and, moreover, they often act as a sort of police power in the prevention of litigation. The knowledge on the part of a sub-contractor that the general contractor has dated photographs of the work on which he has been employed, will tend to discourage the presenting of unjust claims. Cases of dispute which have come up, and which otherwise would have gone to court, have been satisfactorily settled when the photographic records were referred to.

359. If a company employs its own photographer, there is an advantage in having a man who has some knowledge of engineering. In fact, some concerns consider an insight into engineering problems of more value than an expert knowledge of photography. For securing its photographic records the George W. Jackson Company, of Chicago, has in its employ a man of some technical training who is an amateur photographer. He is engaged continually in

visiting the different pieces of work which the company has in hand, and in addition to the photographs which he takes, he is able to report on any features of particular interest, or answer intelligently any questions which the pictures may suggest to the engineers of the company.

360. **Uses of the Camera in the Factory.**—In the factory the camera can be adapted to an endless variety of uses, limited only by the ingenuity of the manager in applying it and the skill of the photographer in working out practical applications. Here the photographer, in a large number of cases, is a regular employee, having rooms assigned to him in the plant, and occupying a permanent place on the pay-roll.

361. **The Increasing Demand for the Camera in the Factory.**—One company photographs drawings which are sent in to figure from, and which must be returned with quotations. By this method the manufacturer insures himself against the customer substituting another drawing of more expensive construction, and can refer to the photograph at any time a question arises as to the methods of figuring, and other matters, before the contract is closed.

362. Similarly for protection, photographs are taken of the surroundings of a machine when an accident has taken place. This is always done before the parts are disturbed, so that it may be used as evidence in court. These photographs have very often indicated that the person hurt was at fault.

363. **General Drawings and Special Details** of machinery on price-book pages may very well be photographed, in order to facilitate explaining the construction of the firm's manufactured goods to the customer. This saves the annoyance and trouble of carrying around large blue-prints which must be folded or rolled up, and which, after being used several times, become torn.

364. Photography can very advantageously be used for preserving and duplicating confidential records. The Power and Mining Machinery Company, of Milwaukee, reproduced their price-book in this way. And in view of the

fact that this price-book must be revised very often, it is also found to be economical and more convenient, besides more rapid, to typewrite the pages on ordinary commercial paper and then photograph them down to the proper size sheet for the price-book. In this manner a large amount of information can be crowded on a small sheet (necessary because the book is made pocket size) and the characters are very clear. By doing this work themselves, instead of handing it to a printer, they are absolutely sure that the price-sheets do not get into the hands of competitors, as the number of copies is kept track of in the photograph room.

365. The Allis-Chalmers Company attempts to secure a complete set of views for each installation of equipment made. These are used by the sales department as aids in planning tentative lay-outs for prospective customers. (See Illustration No. 78.)

366. Every salesman knows that if he can show a customer just how a thing is going to look when completed, he has gone a long way toward awakening the interest which leads to a sale. Especially is this true in an elaborate lay-out of electrical apparatus, about which the purchaser sometimes knows little and feels a large degree of uncertainty.

367. **Photographs for Advertising.**—The publicity department of this company also makes extensive use of the photographs of completed installations. Articles are prepared by the department's technical writer describing the equipment in detail. This article is mimeographed, and a copy, together with a set of the views, sent to a large number of publications likely to be interested.

368. Photographs of important pieces of work are taken as they progress through the shop, as, for instance, a group of views of a steam turbine in different stages of completion. (See Illustration No. 78.) These are used to familiarize those in both the mechanical and business departments with the work which is being done, as well as to assist in accomplishing the other ends which have already been mentioned. Copies of all photographs are filed in a

vertical file in the photographic department. For this purpose they are mounted on a piece of white 6-ply cardboard, $8\frac{1}{2} \times 11\frac{1}{2}$ inches in size. The prints are attached only at the upper edge, as pasting over the entire surface would inevitably cause a warping of the cards, making them very inconvenient to handle in the file.* The upper margin of the card is printed with suitable blanks for records, as shown in the reproduction. They are, for the most part, indexed under the name of the installation, as "Patapsco," "Kern River," and the like, as well as being cross-indexed for the kind of equipment, as "Steam Turbines," "Dynamios."

* Prints may be mounted solid to the cardboard, if dry mounting-tissue is employed. This tissue, together with the simple manner of applying it, is thoroughly described in Volume IV.

CHAPTER XVI.

Construction Work.

Part II.

Practical Application.

369. The application of photography to construction work, and its value, can be no stronger exemplified than in the use which the Arnold Company—engineers and contractors—of Chicago, are making of it. Through the kindness of Mr. P. L. Battey, the Chief Engineer of the Railway Shops Department of this company, we are able to reproduce herewith two series of illustrations, which very clearly show the immense value of photography in this particular line of work. The prints are actual construction photographs, having been taken from the regular office records of the Arnold Company.

370. The series which we reproduce by no means comprise the complete set of views which this company had made of these subjects. We simply reproduce a sufficient number to show the application of photography to construction work.

371. The series shown in Illustrations No. 79 and No. 80 illustrate the construction of the Stratford, (Ontario) shops of the Grand Trunk Railway System, for which the Arnold Company are engineers and surveyors. The Locomotive Shop Building, illustrated, is on the site of the old shop, and due to the requirement of minimizing the interference of the regular work of the Railway Company, the building was put up in sections. These photographs show the first fifteen bents, of which there are twenty-seven.

372. The series of views shown in Illustrations No. 81 and No. 82, (which have been lettered in alphabetical order) are construction photographs Nos. 4D, 24D, 48D, 56D, 68D, and 76D. These were all taken from one of the towers referred to in Paragraphs 341-343 of the preceding chapter, and will give an idea as to the progress of this particular part of the site. Of course these views only take in a portion of the work, and are not indicative of the progress of the remainder.

373. The area covered by the camera in these photographs is a number of acres, as the entire area of the plant covers about forty acres. Supplementary views of course were taken, showing particular methods and types of construction throughout the work, in addition to the four general views.

374. The towers referred to above and shown in the diagram (Illustration No. 77) are the ones employed in making this series of records. One of the towers is included in all of these photographs (with the exception of No. 4D), and will be observed in the extreme distance, a trifle to the left of the center.

375. Although it is not always possible to use this particular method of taking pictures on all work, it is the aim to do so as consistently as the conditions will permit. Where towers are used, the photographer simply sets up his camera at the regular time and makes the exposure without any special instruction from the superintendent or representative of the company at the time, the whole proposition being pre-determined.

376. In regular construction work the Arnold Company takes the pictures every two weeks, and the prints are bound in their regular graphical progress charts, covering each section of the work, a copy of which goes regularly to the client.

377. A number of the large railroad companies for whom the Arnold Company has handled construction work, and upon which they have used their regular system con-



Courtesy of the Arnold Co., Chicago

Illustration No. 79
Construction Photographs—A Series for Record Work
See Paragraph 371



Courtesy of the Arnold Co., Chicago

Illustration No. 80
Construction Photographs—A Series for Record Work
See Paragraph 371



Courtesy of the Arnold Co., Chicago

Illustration No. 81
Construction Photographs—A Series for Record Work
See Paragraph 372

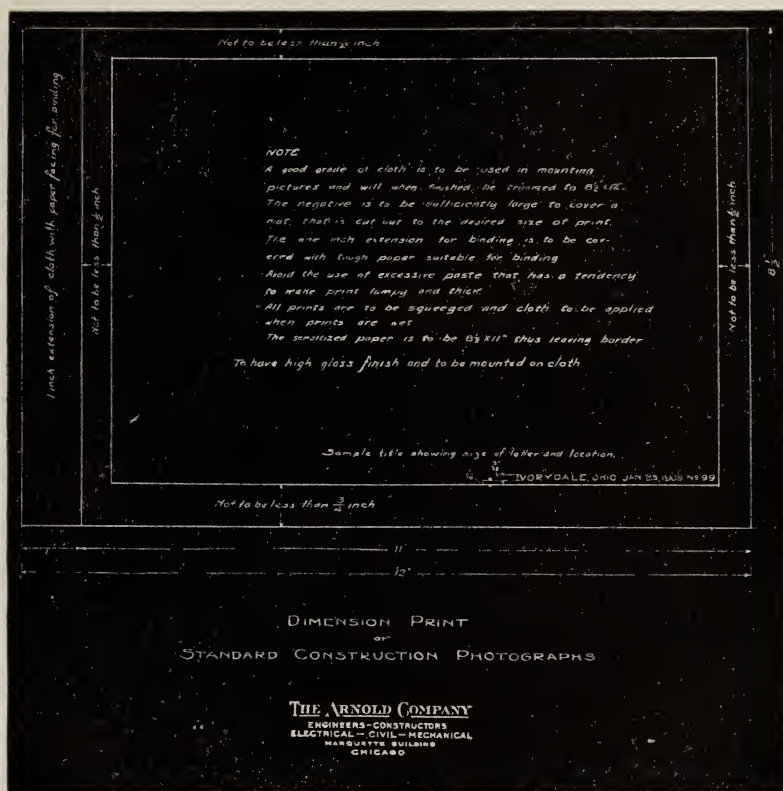


Courtesy of the Arnold Co., Chicago

Illustration No. 82
Construction Photographs—A Series for Record Work
See Paragraph 372

struction reports, which include the photographs, have adopted the same system, and are using it universally upon all of their construction work.

378. Prints of Uniform Size.—All prints are of the



Courtesy of the Arnold Co., Chicago

Illustration No. 83
Construction Blue Print
See Paragraph 380

same size, and are bound in the same manner, the lettering appearing in approximately the same location and in approximately uniform type throughout.

379. It is not always possible for the contractors to take their own photographs. As a matter of fact, it is found

to work out quite as economically and advantageously to contract with a local photographer convenient to the work in hand, who has a regular time to take the photographs every two weeks, and who makes them in accordance with a standard specification which is furnished by the engineers.

380. In Illustration No. 83 is shown a reproduction of a blue-print which the Arnold Company supplies to the local photographer. This blue-print is a *fac simile* reproduction of the diagrams and detailed instructions for the photographer to follow in making pictures for them.

381. **Value and Uses of Photographs.**—There are an endless number of ways in which the photographs may be used by the contracting engineer, such as: For bulletin illustrations; for post-cards, which are issued monthly to the regular mailing list of railway officials and others; for constant reference in the office for engineering, estimating and designing purposes. The latter may not seem of much importance, but it is surprising how frequently the photographs come into service. One of the principal advantages of the photographs is the assistance they give in keeping the office and the field organizations in touch.

382. A great deal of the work might be termed "rush work;" that is, sometimes work is begun upon both the plans and the actual construction almost simultaneously. This was the case in the Springfield work, and in cases where plans are being made to keep ahead of a large construction force, doing the particular thing that needs to be done at the right time, it is very handy to refer to the photographs as they come in, as they often show conditions of work illustrating a great many details, which would require considerable correspondence or a trip to the work.

383. Photographs are used for illustrations and records of defective material, machinery, etc., and while it is seldom necessary to use any of these as evidence in any controversies, they are a very desirable thing to have.

CHAPTER XVII.

Construction Work.

Part III.

Detailed Working Conditions.

384. The application of photography to construction work is not confined alone to the large companies and engineers, for if *they* have found it of inestimable value it is quite certain that all engaged in work of this nature will find that the use of photographs not only saves time and money in the ways previously mentioned, but they facilitate, to a great extent, the actual work of construction.

385. The superintendent of the work should have a sufficient knowledge of photography to at least be able to operate the camera and give instruction intelligently with reference to the finishing of the pictures. There are times, however, when it is preferable to have a regular photographer attend to the securing of the views. For this reason every photographic worker should be thoroughly informed with reference to the requirements of the engineers, so that he may be able to supply the highest class of work. The general instruction contained in this volume regarding the photographing of machinery, etc., should be thoroughly mastered, in order that one may intelligently reproduce all detail work. Instruction regarding the making of general views of plants and buildings, in fact, all architectural subjects, is contained in Volume III.

386. **Apparatus—Camera and Lens.**—The necessary outfit for record of construction work can be covered with two cameras, one an 8x10 fitted with a rectilinear

or an anastigmat lens, the other a pocket or hand film-camera. The 8x10 camera is used for all record work, and, therefore, such a lens should be used as will give perfect rectilinear lines. For this purpose a high grade Extra Rapid Rectilinear or an Anastigmat lens should be employed.

387. The camera should be one having as many attachments as possible, and especially is it desirable that the back have both horizontal and vertical swings, and that the front be of the rising and falling type. The bellows should be of sufficient length to permit one to use the single combination of the lens, which combination usually has a focal-length approximately double that of the complete lens.

388. **The Tripod.**—The tripod should be extremely rigid, for often it will be necessary to stop the lens down to a very small aperture, which will require exposures of some little duration. The aim in every case should be to secure an exact record of facts with perfect accuracy. If the tripod were not sufficiently rigid, a slight breeze might ruin a negative, by causing a blur or a double image to be registered on the plate.

389. **The hand or film camera** is employed for special work illustrating different circumstances and little incidents that occur during the day, for which a small picture is sufficient, and the film camera is very convenient to handle, and is always ready for operation.

390. **Plates.**—Any ordinary plate will answer the purpose for the making of architectural and general construction negatives. As most of the work is made while men are at work, a rapid plate will need to be employed, for when workmen and continuously moving objects, such as teams, cranes, derricks, etc., are included in the view, quick exposures will be required in order that no movement of these objects be recorded, and in such cases a rapid plate is a necessity, but no specially corrected plate, such as the orthochromatic plate, will be required. The only advantage of such a plate is apparent when the construction work is badly scattered and a large area is to be taken in the view; then the use of

orthochromatic plates with a four-times screen would assist in obtaining a more accurate rendering of the scene.

391. **Level.**—It is essential that all lines be absolutely perfect, and for this reason the camera should be accurately leveled. Although it is possible to judge approximately on the ground-glass when the lines of the building are rectilinear, yet a small pocket level, which will enable you to set your camera perfectly plumb, should form a part of the equipment.

392. **Time of Day and Light Conditions.**—First of all, an exposure should not be made at a time of day when it is necessary to point the camera directly toward the sun. An hour should be chosen when the sun is to the rear or to one side of the instrument. Veiled and foggy negatives would result if the strong rays of light were permitted to strike directly, or even indirectly, onto the lens or interior of the lens barrel. Usually it is preferable to have the sun to one side of the camera, for in this position it will cast shadows, which will give relief to the various parts of the structure, and also materially aid in giving a more adequate idea as to the character of the most minute details. It is more preferable to make the exposure when the sun is under a cloud than to do so when the piercing rays cast extremely heavy shadows. With this latter lighting effect the high-lights will be extremely hard, and the detail in them lost, if enough exposure is given to secure a record of the detail in the deeper shadows.

393. It is, of course, necessary to make the photographic records at stated intervals, and for this reason it may not always be possible to work under the most favorable conditions; but if the photographer will, with the superintendent of construction, lay out a systematic plan for making the series of records, objectionable lighting effects may be almost entirely eliminated, as the most favorable time of day may be chosen in which to make the exposures.

394. **Exposure and Development.**—The exposure will depend, to a great extent, upon the lens, plate, size of stop,

and weather conditions, as well as the nature of the subject being photographed. Full exposure must in all cases be given; under-exposure would result in a negative lacking detail in the shadows. This latter is undesirable, as it is essential that even the most minute detail be shown in the construction photograph. It is far better to slightly over-expose the negative, for by exercising proper judgment such a one can be very easily controlled in the development, and even though the resulting print may be a trifle flat it will contain a detail record of facts.

395. In cases of known over-exposure, the development should be so handled as to enable a negative of proper contrast and gradation being secured. Full instruction regarding the handling of over-exposures is thoroughly covered in Volume II.

396. When the extreme of exposure has been given, it is preferable to carry the development beyond the normal stage, and then, after fixing, reduce with the potassium ferricyanide reducer. (See Volume II.)

397. The suggestions contained in these chapters on construction work should be most carefully studied, as they are based upon the practical experience of one of the largest engineering companies in this country. The securing of detailed interior photographs is covered in Chapter VIII, which gives instruction on the photographing of machinery and all interior details.

398. **Finishing the Prints.**—It is preferable to finish the print on glossy paper—either a developing paper or a printing-out paper. The method of mounting for the record files is comprehensively shown in Illustration No. 83, which is a reproduction from the regular blue-print diagram supplied photographers by the Arnold Company, of Chicago.

399. Volume IV contains detailed instruction regarding the printing and finishing of all classes of photographic papers.

CHAPTER XVIII.

Commercial Groups.

400. The photographing of groups of large bodies of men, women or children, or mixed crowds, such as conventions, parades, etc., will occasion but little difficulty to the one who has carefully followed the instruction, in previous volumes, on this subject. With very large groups, however, the conditions are somewhat different. Frequently the photographer has to consider more the question of *how* to get his picture and *how* to get the crowd on to the limited space of his plate, than *how* to get the best lighting or most effective posing.

401. **Groups Outdoors.**—In such instances, the photographer has little to consider but the question of speed and appropriate surroundings. It is frequently possible to arrange the groups on a sloping ground, or on the steps leading to some large public building. This enables the photographer to get a clear view of each individual. Where this is not possible, the photographer must place his camera on an elevation, by means of an extra tall tripod. These tripods can be obtained up to eight feet and more in height. When an ordinary tripod is employed, a temporary platform may be constructed out of a few wooden boxes, and the tripod placed on them. A big crowd photographed on level ground, with the camera on the same level, will make anything but a satisfactory picture, and would probably result in sales only to the fortunate few in the front ranks. Where sloping ground is available, or large steps leading to some public building, it will be found a good plan to arrange the group with more depth than width, and thus not only give the appearance of a larger group, but you may work closer to them.

402. **The Lens.**—The lens should be a thoroughly good instrument, covering the plate it is made for sharply to the very edges. A first-class rapid rectilinear, one that cuts to the edges of the plate at f.8, will be a satisfactory instrument, but a good anastigmat lens of any make will, of course, give greater brilliancy and flatness of field. Not much will be gained in speed, however, by using these lenses, as considerable stopping down will usually have to be done to get both the front and the rear of the group in sharp focus.

403. **Focusing.**—A point a little inside of the center of the group should be selected, and the ground-glass focused with the lens wide open. Then stop down gradually until both the front and the rear figures are equally sharp. A lens of too short a focus will result in the distortion of the faces at the sides of the group—hence a normal-focus lens should be employed. Where the group is arranged in pyramidal form, on steps, etc.—one tier back of the other—the swing-back of the camera should be used to assist in bringing the rear and front of the group into equal focus.

404. **Lighting.**—The lighting should, of course, be from the side, or rather, half-way between a line drawn through the camera and one joining it at right angles. In other words, the light should not come from back of the camera, nor yet entirely from the side, but between. Late afternoon is the best time of day, if the choice is with the photographer. A cloudy day is the best for all out-door groups, as the light is then softer and more diffused. Failing this, arrange your group, if possible, in the shadow of a building, when similar conditions will prevail. If the picture must be made in the sun, then, with the sun shining from the left of the picture, have the members of the group turn their heads toward the right—or, in other words, away from the sun—when squinting of the eyes is entirely overcome. A broader and more even lighting is then obtained, which, with a softly developed negative, should give a most satisfactory picture.



Photo by T. E. Dillon

Illustration No. 84
Commercial Group
See Paragraph 406



Illustration No. 85
Regimental Review
See Paragraph 406

Photo by T. E. Dillon

405. The essential points are: Get above the group, or have your group so arranged that each row of people stands higher than the front row; get each individual as large as possible; have sharp definition, and get as good lighting as possible, avoiding harshness on the one hand, and flatness or over-dark faces on the other—artistic effects are seldom desired or wanted for commercial work.

406. **Small Groups.**—These should present no difficulties other than those already described in previous instruction. The skill of the photographer will show itself in the arrangement of the individuals and the selection of suitable background material. Illustration No. 84 shows a battalion of soldiers in camp, in which all the requirements of good commercial grouping are preserved. The background of tents and trees is appropriate; the ends of the group are not too square, and there is little difference between the sizes of the faces in the front line and those in the rear, all being equally sharp. In Illustration No. 85 grouping of a different kind is shown. This is equally as effective for a company picture, but not as a picture of the individual members, yet will sell readily on account of the memories it recalls.

407. **Convention Groups—Indoors.**—This is work of a more difficult nature. Usually it requires expert flashlight knowledge to get the most successful results, and we treat of this in another chapter in this volume. In most cases the photographer is allowed to take the picture from the stage or platform, his flashbags or machines being distributed throughout the hall, to give as even an illumination as possible. The use of a normal focus lens is not always possible. A wide-angle lens will generally have to be used, but it should not have too short a focus; otherwise the faces of the people at any distance from the camera will be very small.

408. **Panoramic Groups.**—A very effective and pleasing (because out of the ordinary) form of grouping can be accomplished by the aid of the panoramic camera. This instrument, in its most perfected form, is best represented

in the Cirkut camera, made in various sizes by the Century Camera Company. There are other forms of panoramic cameras, but this one is typical and gives the most effective picture.

409. **Description of Camera.**—The Cirkut camera is provided with a long bellows, so that a long-focus lens can be used, giving better proportions of picture than with the ordinary panoramic instrument. The lens is relatively stationary, while the sensitive film (plates cannot be used) is relatively moving during the exposure. The film moves past a narrow vertical slot, at the back of the camera, at a certain speed, which is in proportion to the speed with which the camera itself revolves. A special tripod has to be used with this camera, which has a revolving apparatus attached to its base (enabling the camera to make a picture of 360 degrees, or a picture of any length up to that). The revolution of the camera can be stopped at any point. A scale on the top of the tripod shows at a glance where to stop the camera for any desired length of picture. One pressure of the bulb attachment starts the camera and another pressure stops it.

410. **Making the Group.**—In using a panoramic camera in which the lens revolves about a fixed point, it is clear that if a long, straight building were being photographed with the camera exactly opposite the center of the building, with the part of the building opposite the camera in focus, the two ends of the building will be very much out of focus; even though the lens was of universal focus the ends of the building would be so much further away from the camera than the center that their images would be very much smaller. The same happens with a group, and in making a group of people it is naturally desirable to have them all, as far as possible, appear of equal size. To achieve this it will not do to arrange the individual people in straight lines, as would be the case when photographing with the ordinary camera and long-focus lens.

411. To get a satisfactory panoramic group it is necessary to arrange the people in a semi-circle, or any part of a

circle, around the camera. This is very easily effected by focusing on one or two of the group, at the distance best suited for obtaining a fairly large image. Using this distance as the radius of a circle, group the remaining people around the camera at the same distance. A piece of string the length of this radius, with one end attached to the camera and the other end brought to each individual in the front row of the group will insure the correct distance from the camera being obtained. A very large group may necessitate the arrangement in a complete circle. (See Illustration No. 86.) A small group can be arranged to fall within 12, 14 or 20 inches of film length.

412. As the camera revolves on its tripod, particular attention must be given to see that the camera is perfectly level, otherwise considerable distortion will appear in parts. It is better to work the camera at a slow speed on windy days, as there will then be less chance of the wind affecting the camera in its revolution. The speed of the camera is controlled by various-sized fans giving speeds from $\frac{1}{2}$ to 1-50 of a second. With this latter speed, fast moving objects can be successfully photographed. Panoramic groups should be made on level ground.

413. **Development.**—The developing of panoramic exposures presents no difficulties, beyond the necessity of having large trays and plenty of solution. Special printing-frames can be obtained for printing the pictures.

414. **School Groups—Out-Doors.**—A profitable phase of commercial group work is the photographing of classes of school children, especially in public schools. In the larger cities, these classes often average forty or more children, the majority of whom may be depended upon to buy a picture, if their faces show up well. The photographer should either make the acquaintance of the individual teachers and persuade them to get permission from the principal for him to photograph the children, or else go direct to the principal. Some principals are averse to letting strange photographers make pictures of the children, but it should not be a difficult matter to become acquainted

with some of the children or their parents, and thus get an introduction into the school.

415. The best time to do the work is in the early morning, after the opening exercises. The children are then in the best of spirits. The school yard is usually large enough, and one or two benches can always be borrowed from one of the class-rooms. Group the children in the most effective manner, the teacher in the center, the smaller ones nearest her or sitting down in front, the middle-size children on the benches, and the tallest arranged behind the latter. Very effective pictures can be made with the children at their games under the leadership of the teacher. These find a ready sale, and often can be sold to the local newspapers, as well.

416. Never attempt to joke too much with the children, especially if they are young. If they once get started laughing it is a difficult matter to quiet them when you want to take the picture. Work quickly and quietly, as there is usually little time to spare. Give a couple of sets of the pictures, mounted exactly as they will be when delivered, to the teacher as soon as possible. The children will draw their impressions of the pictures from these samples, and will tell their parents accordingly. Provide the mounts, if possible, with a little printed strip, giving the name of the class and teacher. Half a dollar will be about as much as can be asked for such pictures, but at this rate, it can be made quite profitable. Use a $6\frac{1}{2} \times 8\frac{1}{2}$ or 8×10 plate and keep the faces light.



Illustration No. 86
Panoramic Group
See Paragraph 411

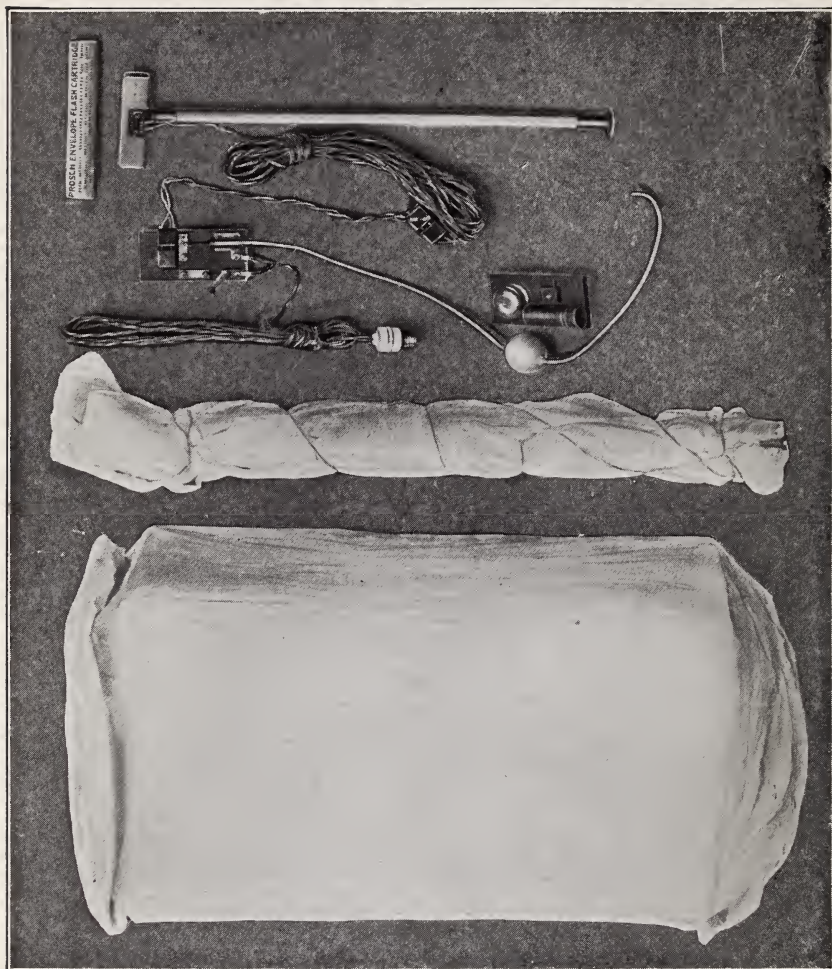


Illustration No. 87
Prosch Flashbags
See Paragraph 420

CHAPTER XIX.

Use of Smokeless Devices in Flashlight Work.

By the Prosch Manufacturing Co.

417. Much progress has been made in flashlight methods during the past few years. The old smoke nuisance is being avoided by the use of special fire-proofed bags, which retain the smoke and permit the light from the flash to pass through in diffused form. This revolution in method has been brought about largely through the introduction during the past few years of the Prosch Smokeless Flashbags and the Prosch Electric Envelope Flash Cartridge, both patented devices.

418. **Various Flashlight Methods.**—It may be well to speak briefly of the other methods of flashlight work still in vogue. Among them, the pure magnesium blow-lamp process is a very efficient and necessary one for interiors and still life, and for commercial, sample, and catalog work, while the newer flashbag process is likely to be confined to the work of photographing people, and for interior work where smoke must be eliminated.

419. **Magnesium Lamps.**—Pure magnesium blow-lamps are made in many sizes and forms, prices ranging from \$1.50 to \$30.00 for a single lamp outfit. In these lamps pure magnesium (which is finely ground magnesium metal) is blown from a tubular reservoir up through a spreader, or V-shaped projector, in a wide, but very thin, sheet, through an alcohol flame, which, if the magnesium is of the proper grade and quality, completely oxidizes it, creating an intense white light. If not of the proper grade there will be some sediment of partially consumed magnesium. During the

burning of this magnesium, the operator, who is holding the lamp in hand, walks to and fro behind the camera, raising and lowering the lamp to throw the light on every possible shadow that might be cast by the article being photographed. In commercial work (for which these lamps are used) flat lighting—that is, absence of all shadows—prevails, while in portrait lighting, side lighting must predominate to produce good modeling.

420. **Flash-Lamps for Compounds.**—There are also lamps for using ordinary explosive flash powders. These are still more numerous in style, design and methods for igniting the powder. The methods for igniting explosive powder in these lamps require the burning of alcohol, which is extremely dangerous when used near such powder; burning ether, which is more dangerous; percussion caps; burning punk; all of which are limited to the firing of one lamp at a time. Electricity, however, is by far the safest and the most successful method to employ; and in addition it can be made to set off almost any number of lamps simultaneously. The development of the electric flash-lamp, by the Prosch Manufacturing Company, has led to the introduction of the Prosch Flashbag, which is shown in Illustrations Nos. 87 and 88.

421. **Flashbags.**—The flashbag comprises, *first*, a fire-proofed, pure white muslin bag, made in peculiar form, extensible and collapsible by means of various styles of frame-work; *second*, a special style lamp made to ignite electric cartridges or loose powder by means of electric current; *third*, wiring; and *fourth*, switch-board necessary to carry the current to the bag-lamp and to control its use. The flashbags are generally used in sets of two or more, as the maximum amount of powder that can be set off with perfect safety in the ordinary flashbag is one-half ounce. A lamp of peculiar shape is necessary for ignition of powder inside the bag, as the flame must be directed straight upward so that it will not char the cloth. The patented form of lamp (which is a piece of sheet metal bent up against itself to form a long pocket), or the patented elec-

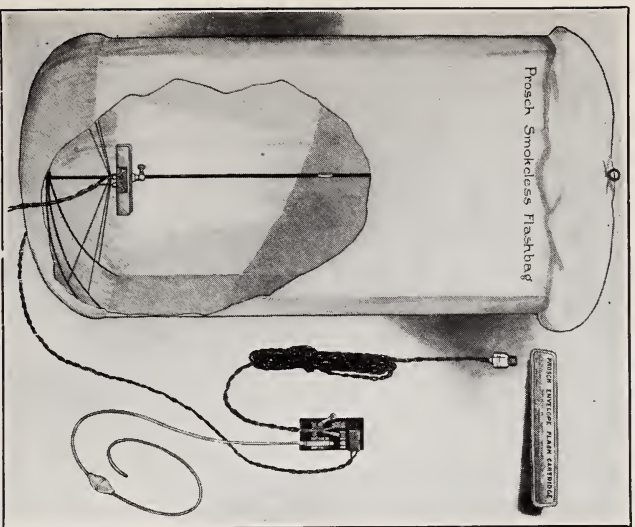


Illustration No. 88
Prosch Flashbags
See Paragraph 420

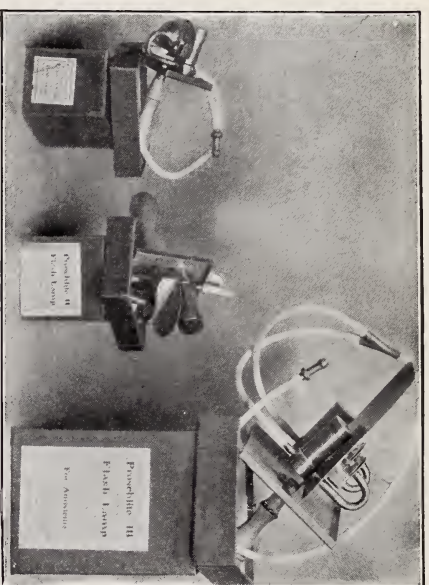


Illustration
No. 89
Prosch
Flashlamps

Illustration
No. 90
Prosch
Flashlamps

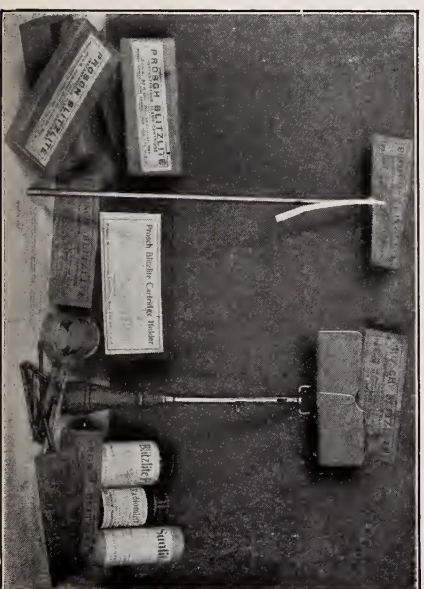




Photo by William H. Rau

Illustration No. 91
 Banquet—Illuminated by Flashbags
 See Paragraph 432

tric envelope cartridge (which has the same form as the lamp described), make use of the only safe principles for a bag-lamp. These force the flame upward into a thin sheet of great area, which increases the illumination about 50%.

422. **Cloth for Flashbags.**—In use the flashbag is securely tied so that practically no smoke escapes from the flash, excepting that coming through the pores of the cloth, which is unavoidable. The cloth must not be heavy enough to cut down the intensity of the light too much, nor so light that it will not hold most of the smoke; therefore, in the flashbags on the market, the medium weight of cloth is used. This cloth must be of an excellent quality, to take the fire-proofing well and permanently. Poor grades of cloth do not hold the smoke and are not so safe to use. The flashbag, therefore, must be made most conscientiously and carefully.

423. **Diffusion of Light.**—In use, also, the light of the flash illuminates the whole flashbag like a Welsbach mantle, and diffuses and spreads the intense light in all directions. For this reason this form of flashlight is most remarkably superior to the open flashlight for actual photographic work, even leaving out of consideration the elimination of the smoke. It is destined to take the place of all open flashlight work.

424. **Fire-Proofing Flashbags.**—Just a word about fire-proofing of flashbags before taking up the next topic. There are numerous methods of fire-proofing, or so-called fire-proofing. The disastrous results experienced by those photographers who thought they could save money by doing their own fire-proofing and making their own bags proves that it is wise to leave such important matters to those who know how to do it properly. It is true that almost any kind of fire-proofing will last for a short time, but, unless it is done permanently, the bag imperfectly treated may blaze up at the most unexpected time and cause untold damage. A concern that makes a specialty of making flashbags for use in the most particular places will be absolutely

certain that its fire-proofing will be of the permanent quality. Flashbags are things that no photographer has any right to make in a crude way, thus endangering the property of others.

425. **Classes of Work.**—Now the question is asked, how are flashbags used, and for what particular kinds of work? Let us divide their use into two classes—*small work* and *large work*. By small work, we mean the use of a two-bag outfit for portraits, groups, dinners and weddings, mostly in studios, homes, churches, social halls, leaving all hotel and club work, whether large or small, in the class of the large worker. The latter operates almost exclusively in hotels and clubs, and most of his work is in photographing banquets and other large social events. (These two classes of work are distinctive, and the same photographers seldom do both kinds to any extent; so we will treat of them separately.)

426. **Professional Photographer's Equipment.**—In the studio one flashbag can be used to advantage when the reflector is employed. Ingenious devices are being made to enable the operator to make repeated flashes without the trouble of emptying the smoke each time. But if the studio photographer is going to make the most of his flash-light opportunities, he must be prepared to go into his patron's home to take interiors, dinners, weddings, etc., without giving any annoyance. In this way a dozen negatives can be made in the home to one made in the studio. For this work he will need only a two-bag outfit with electrical fittings so that he can use batteries in case the home is not fitted with incandescent current.

427. The regular studio photographer would be very unwise to try to get the large banquet work in hotels, unless he is willing to equip himself thoroughly for this important work. The average studio man is content to confine himself to what two or three bags can be made to do. For group work three bags are better than two, just as two are better than one, because it is necessary to get a strong side lighting to give good modeling. In all two or three-bag work the

heaviest charge is placed at the side, with a weak light in front of the group, behind the camera.

428. **Large Work.—Banquets, Etc.**—As to the class of large work, let us say that this is becoming very rapidly a distinct profession in itself, and requires good business ability outside of the regular photographic ability. It is as different as newspaper photography from the ordinary photography. While it requires considerable practice and skill to get the best results in using bags for banquet work, under the exacting conditions that prevail, it also requires considerable maneuvering to get the hotel work to do, to get the information about dates of future banquets, to get ahead of the other fellow who is free with his fees to the stewards, head waiters, etc., to convince the manager that this is a free country, that hotels are public places, and that he has no right to favor one photographer more than another.

429. **Special Apparatus.**—Then, hotel work takes not only generously large outfits of flashbags to always have enough in reserve to cover several banquets at the same hour, but it requires special cameras, and sometimes special lenses, in order to get prints in which all heads are large enough to draw forth the two or five dollars from the respective owners. Most of the big flashbag operators in New York have as many as fifty to seventy-five bags each and they have several suitable cameras for the work.

430. **Time to Make Exposure.**—The invariable custom is to make the exposure when the guests take their seats, and then show finished prints before the dinner is over and before the speeches begin. This is the harvest time for these photographers. They frequently take in as much as \$500 from a single banquet, and seldom less than \$50.

431. **Cost and Profit.**—The expense for powder, or electric envelope cartridges which most of them use, for a large banquet is not over \$1.50, for assistants not over \$5, and for plates and developing only a dollar or two; so there is an immense profit in this work. Most of this work is done on speculation, and for this reason the greatest difficulty confronting the photographer is to get ahead of all

competitors by being on confidential terms with the hotel management. This will enable the photographer to know about dates for banquets. There are plenty of good opportunities for this work, and in New York City there is enough of this work to support fifty such photographers during the entire season. The conditions in other cities are somewhat similar.

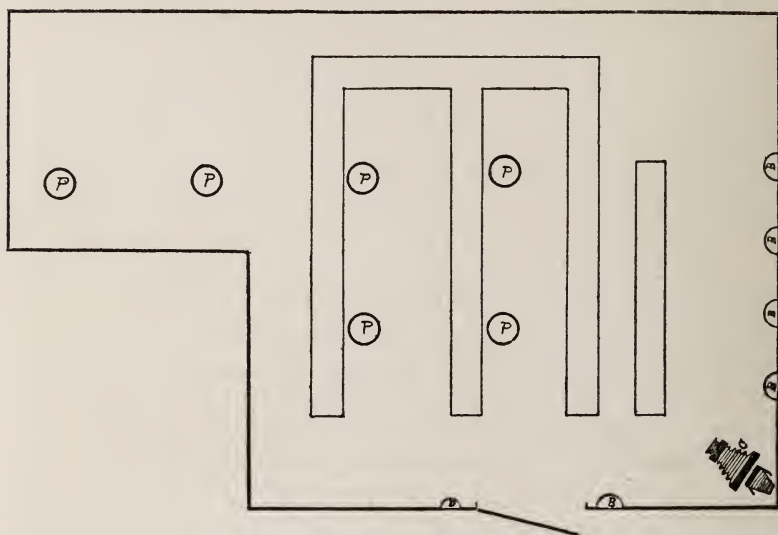


Illustration No. 91a
Banquet—Illuminated by Flashbags—Floor Plan
See Paragraph 434

432. **A Commercial Group.**—In Illustration No. 91 we present a smokeless flashlight group picture of the professional photographers of Pennsylvania taken at their banquet held at the Hotel Walton, in Philadelphia, during their state convention. The picture was made by Mr. W. H. Rau, of Philadelphia.

433. The smokeless flashbags used in making this excellent picture are the results of exhaustive experiments on the part of Mr. Rau, whose eagerness to secure pictures by flashlight, less the offensive after-smoke, has resulted in



Illustration No. 92
"Putting on the Degree"
(Flashlight)
See Paragraph 436

Photo by T. E. Dillon



Photo by T. E. Dillon

Illustration No. 92a
"Swimming Pool"
(Flashlight)
See Paragraph 436

the successful flashbag apparatus used on this occasion. Mr. Rau's success with these flashbags has been the means of encouraging manufacturers of the old style machines to seek similar improvements, with the result that today the Prosch Manufacturing Company has placed upon the market the simple and practical flashbags previously described.

434. **Method of Procedure.**—In making the group picture for the above illustrations, Mr. Rau used six flashbags—four at the side and two at the front of the group, with the camera placed in the corner of the room between the two sets of flashbags. (See Diagram No. 91a.) A large 10-foot tripod was used to support the camera, while a step-ladder was employed for focusing. Victor flash-powder was used, about $\frac{1}{4}$ ounce in each bag, and the flash was made by using an electric current from the building. The size plate employed was 18 x 22, Cramer Crown. The camera was fitted with a 7-A, 16-inch focus, Goerz Dagor lens, stopped to f. 16.

435. **A Valuable Suggestion.**—A very clever device arranged by Mr. Rau, which created much amusement for the guests, was as follows: Cartoons of some of the prominent members present were sketched on white canvas and, folded in a neat little roll, were placed on the top of each flashbag, with the top end of the sketch pinned fast. When the flash was set off the concussion of the powder caused the cartoons to drop over the front of the bags, thus serving to hide the bags and also furnishing fun for the guests. The bags were left intact until after the guests had adjourned, and no effects of smoke or odor from the powder was perceptible.

436. **Quick Delivery of Prints.**—Another very interesting part of this demonstration of smokeless flashlight was, that within 36 minutes by the watch, after the flash was made, two mounted photographs of the group were circulated through the audience, for inspection. The financial success of flashlight work depends on quick results. It is important to have one or two solicitors with samples of fin-

ished prints, mingling among the guests, securing their orders and collecting the amount while they are interested. Never depend upon obtaining orders after the guests have departed, for by that time all interest will have ceased and orders will be hard to obtain at any price. Other examples of flashlight photography are shown in Illustrations No. 92 and No. 92a.

CHAPTER XX.

Press Photography.

437. **Introduction.**—A phase of commercial photography, which has grown with leaps and bounds during the last few years, is the making of pictures for the newspapers and magazines. So similar appear the two classes of work that they are generally known as "Press Photography," but in actuality the work of the newspaper photographer is vastly different to that of the photographer who supplies magazine illustrations. The former is all for speed, incident, vivid contrasts, and, above all, vital action.

438. **The newspaper photographer** is ever on the jump, ready at a moment's notice for any assignment—an early morning fire, or a presidential candidate; the scene of a gruesome murder, or the snapping of a foreign noble bridegroom entering the church. His pictures must tell news, just as truly as the reporter's story tells the facts.

439. **The magazine photographer**, on the other hand, prepares his work deliberately. He pictures incidents in series, or hunts up his subject according to the story to be illustrated. He works slower, but must produce more perfect work than his newspaper brother. With these differences in view, we divide our instruction on press photography into the various classes into which it naturally falls.

Part I.

Newspaper Photography.

440. Newspaper photography is one of the newest arts, yet within the past few years it has become one of

the most important. Few papers of large circulation and good standing can afford to ignore illustrations, and in this fact lies the opportunity of the photographer-correspondent, wherever he may be. The demand in nearly every newspaper office is for pictures, pictures, and, again, pictures. A good striking picture is often worth more than a column of reading matter.

441. **The Record.**—One fact must always be borne in mind by photographers who would make money by selling pictures for publication. *The camera is an absolutely faithful witness to what it sees.* The reporter who gathers facts and weaves them into an article may draw upon his imagination, to a certain extent, for “local color” or “atmosphere;” such additions, while often not strictly correct, lend an added interest to the “story”—make it more readable and do no harm.

442. **Striking, Sensational Scenes.**—The camera cannot go outside the range of its vision to gather color romance. The good newspaper photographer always remembers this, so his constant endeavor is to train his camera upon the most striking, dramatic, sensational scenes of any happening he may wish to picture.

443. **Real News Value.**—It is because of his instinctive recognition of (his “nose” for) news and the news value of pictures that the newspaper photographer forges to the front and commands a good salary. Two photographers may take pictures of the same scene or subject; one will make a perfunctory albeit a good picture, the other will get real news value on his plate. It is the second man who will sell his stuff, while the goods of the other go begging.

444. **Action in Picture.**—*For instance:* There is a fire; an important building—although in a small town—may be going up in smoke. Most newspapers illustrating their news would like to have a picture of the actual fire scene. The experienced photographer will not be content to take a snap-shot of the burning building; he will plant his camera in position and wait until he can picture firemen climbing up ladders, or some thrilling scene of rescue. This is getting

"life" or "action" into a picture. The photograph that has "life" in it, although of a comparatively insignificant subject, will sell, when one without "life" or "action"—although seemingly of much greater importance—will be turned down by the news-editor.

445. The photographer, therefore, should always endeavor to get "action" into his picture. He should aim at accessories to the main fact. If he is photographing a street parade it is not enough to picture the parade; he should always endeavor to show some portion of the crowds on the sidewalks, and some of the decorations of the buildings should form a background.

446. If the photographer, then, will always bear in mind that his pictures should have a definite news value, he will have far less trouble in selling them. There is always a demand for such pictures. A snap-shot, however good, of President Roosevelt standing alone would not command a dollar in any newspaper office in the country; every paper has such pictures of the President in stock, without number. But a picture of the President accepting flowers from a little girl, or shaking hands with a cripple on the street, would sell readily.

447. **Ingenuity Brought to a Test.**—Then, too, it must be remembered that it is not the photographs most easily obtained that sell best. The newspaper camera man must exercise the greatest ingenuity, the most daring resourcefulness. This is not always at hand, as it would seem. If one can get a better photograph of a procession or some other event by climbing a tree, the extra exertion will be forgotten if his pictures sell over those of the man who remained on the ground. Always bear in mind, if one man can do a certain thing, another, most likely, can do the same; never be discouraged by seeming obstacles. The photographer who shows the greatest resourcefulness in overcoming obstacles is the one who commands big prices for his work.

448. One of the best photographs ever made of an excited political gathering on the street was snapped by a man who climbed to the top of a ladder, far above the

heads of the surging crowd. At another time this man stood on the sill of a window in the twelfth story of a big office building and photographed a parade in the street below, while two men held him to prevent a fatal fall. He secured a picture that was unique—the marching men below resembling pigmies—and that was why his photograph was better than any taken by his rivals. The peculiar angle was such that he could not have made the exposure simply by leaning out of the window; he was obliged to stand outside it and lean far outward.

449. One of the best photographs of an impressive religious service was made by him, in a church, while standing on a pedestal some eight feet tall. It happened that this elevation gave the best light and afforded the best view. His pictures sold in preference to any others.

450. The newspaper photographer must learn his business through experience, always bearing in mind that "news value" and "action" count best of all. The pictures most difficult to obtain are usually the most prized by editors.

451. **Know Your Camera.**—One of the earliest fundamentals to be impressed upon the photographer is, get acquainted with your camera; learn exactly what it will do and what *you* can do with it. The most successful newspaper photographers use a hand camera of the reflex type, with a focal-plane shutter. One cannot do much with a camera smaller than 5 x 7. These pictures can be enlarged if desired. For flashlights, big gatherings, etc., the size runs up to 11 x 14.

452. **Good Lens—Fast Plates.**—One should have the best lens obtainable and the fastest plates—plates that maintain their quality in all temperatures and do not harden in winter or soften in summer. The plates recommended for Press Photography are Lumière Sigma, Hammer Red Label, Seed Gilt Edge (27) and Cramer Crown.

453. **Exposure.**—The length of exposure for pictures of different kinds must be learned through practice—it does not take long. The speed table that comes with the reflex

camera gives the exposures necessary under ordinary circumstances, ranging from 1-5 to 1-1000 of a second. The higher speed, however, is largely guesswork. Every amateur knows that on dark days, or toward evening, a longer exposure is necessary than in the bright light of mid-day.

454. **Moving Objects.**—In snapping moving subjects—and such pictures always have a high value in the news-editor's eyes—one must govern his control of the camera and the swiftness of the shot by the position and motion of the subject. One may be endeavoring, for instance, to snap a prominent man, a notorious criminal, or a principal in a celebrated divorce case. *It is much better to catch the subject coming toward the camera, for a longer exposure may be given.* When snapping a person moving across the camera's vision the shot must be made more rapidly, and unless the light conditions are good, satisfactory results cannot always be obtained. *It is especially desirable to get in front of the subject on dark days or when working in corridors, narrow streets or elsewhere in a poor light.*

455. **Flashlight Pictures.**—In making flashlight pictures it is best not to have the lamp on or too near the camera; when people are thus photographed, gazing directly at lamp and camera, their faces usually show ghastly and with strained expressions. If you have only one lamp, place it several feet to one side of the camera, or as far away as six feet if the light from the lamp is strong enough. Whenever possible, it is best to use two lamps, a smaller one beside the camera and the other some six, eight, or more feet to one side. These are flashed simultaneously. It is well to practice making flashlight pictures; photographs of happenings at night very often prove of immense value to newspapers.

456. **Finishing Negatives.**—When there is plenty of time, the photographer doing work for a paper in another city finishes the work himself; but it is seldom he has time for this. The majority simply send in the plates and let them be developed in the newspaper office. Nearly all

staff photographers sent out from the home office do this.

457. **Label Each Plate.**—It must be borne in mind that each plate must be distinctly numbered or labeled, so that it may be identified by means of the explanatory letter, telegram or telephone message the photographer sends. The identifying caption should be explicit; not merely "Street Scene in Scranton," but "Scene of Masonic Parade at First Street and B Avenue."

458. **Intelligent Systematic Work Counts.**—To be successful, the newspaper photographer must carefully study his camera and become capable of getting the best work out of it; he must attend to orders promptly and be quick to seize the possibilities for making sales; above all, he should get "action," "life" and "dramatic interest" into his pictures. Always endeavor to get the plates to the awaiting newspaper as far in advance of press time as possible, as each news-editor likes time to arrange for a striking "layout" of his illustrations by the office artist force.

459. **Key to Class of Pictures Demanded.**—Watch carefully the big newspapers that use illustrations freely. Observe the kind of pictures to which they seem partial and you will soon learn how to please. And bear in mind that one picture of human interest—something with life and a story in it—is worth a dozen photos of buildings, monuments and other inanimate objects.

CHAPTER XXI.

Press Photography.

Part II.

The Local Press Photographer.

460. In many cases the photographs published in daily or weekly newspapers, magazines, etc., are supplied by regular press photographers, but a large percentage of those used for this purpose are secured in other ways. The larger publications have a photographic staff of their own, but the smaller periodicals depend, to a great extent, upon photographs sent to them by contributors.

461. **Special Contributors.**—The majority of publications keep a special file wherein they have listed the names of photographers located in different communities, upon whom they may call at any time for special work. It is an easy matter for one to have his name placed on the files of various publications. If the pictures submitted are satisfactory they will be immediately accepted, and each success attained will place you in greater confidence with the publishers, and they will assign work to you more often if they feel positive that you will be able to comply with their requirements.

462. **Promptness.**—One cannot be too prompt in carrying out orders thus given, for promptness and quality of work are the two greatest essentials to success.

463. **Unlimited Field.**—The field for this class of work is absolutely unlimited, for one located in any section of the country may, from time to time, obtain excellent prints of great value, especially for the weekly journals.

464. **Story with the Prints.**—Although the prints themselves are of value, if one can supply some interesting data regarding the picture and the incident which it represents, the reward will be far greater than if the prints are simply submitted without the article.

465. To be able to write a little story in connection with the picture makes one's work still more valuable. It is not necessary to have any great degree of literary ability, nor are the editors as exacting as the inexperienced person is apt to believe. The essential features of an article of this kind are, *first*, tell the story in a simple, concise and clear manner, *second*, give all of the facts, and, above all, be prompt in sending the manuscript and prints to the editor. Of course, one should be grammatically correct in one's sentences and description, yet it is not necessary to use stylish phrases nor extended descriptions. An editor wants the actual facts, concisely put, so that he may publish the necessary data with the pictures. The photographer will find it quite profitable to make special efforts to secure full information regarding the event he has photographed.

466. **Foundation of Success.**—There is always a certain amount of interest attending the securing of special work, for a failure to secure the photographs that one is commissioned to obtain usually results in loss of confidence by the editor, while, on the other hand, each success increases one's chances of securing more commissions from a publication, and eventually it will be possible to find a place on the regular staff of some large publication.

467. **Strong Competition.**—One of the greatest pleasures, however, in this work is in the competition (which is generally strong) to secure photographs of any incident. To be successful one must always get the work to the editor before any one else photographs the scene for, although your pictures may be technically better than your competitor's, if his pictures reach the editor first the chances are that his work will be accepted over yours.

468. **Large Profits.**—The profits which one derives from this class of work are greater than with any other

branch one may follow. Sometimes only enough will be derived from the sale of prints to pay for your material, while again one photograph may bring enough to pay for two or three months' expenses. The price usually paid, however, varies from \$2.00 to \$15.00 per print. Special occasions and photographs of prominent events—those of world-wide interest—bring from \$50.00 to \$500.00 each.

469. **Subject Material.**—The list of subjects that come under the head of press photography are without number, for they not only comprise illustrations for the daily, Sunday, weekly and monthly publications, but also for the trade journals, such as electrical and mechanical engineering, architectural, building, plumbing and gas-fitting, automobile, printing, etc. The daily and weekly publications want pictures of accidents of any kind, and the quicker one can secure such photographs the better. Especially is this true in the case of serious accidents on the street. For instance: when a child is run over by the street-car a crowd will collect quickly and everything will be cleared away, oftentimes before one has an opportunity of getting on the ground and securing anything like a satisfactory picture. Accidents such as railroad wrecks, fires, etc., give one more time in which to get upon the scene and secure a photograph, yet, no matter what the character of the accident, it is necessary to be on the scene just as soon as possible.

470. Photographs of public men as they appear on the street, or entering some prominent building, or while attending some large gathering, are always of value.

CHAPTER XXII.

Press Photography.

Part III.

Athletic Sports.

471. The press photographer is called upon to photograph athletic sports of all kinds, and he should be acquainted, to a greater or less extent, with the particular features of the various games, so that he may photograph the important points—the ones which are most interesting—and make accurate records of the event.

472. The photographing of athletes in action requires a focal-plane shutter. In fact, the best camera to use is one of the reflex type, for with this type it is possible to make the exposure at the exact moment desired. This is important in photographing all moving objects—horses as well as men.

473. The photographs reproduced in Illustration No. 93 show a few of the events taken on an inter-scholastic field day. Figure 1 is the start of a 440 yard run. In photographing the starts of running races the shutter should be released at the second the starter fires the pistol. Always hold the camera low, as it will give the most nearly correct position of the subjects and show them to best advantage. If the camera were held on the level with the eye when one is standing, nothing but the backs of the runners would show. In Figure 2 is shown the finish of a run. The exposure was made at exactly the right instant, for the leader had just broken the white cord stretched across the track. With these two pictures, representing the

start and finish of an important race, and a little story connected with the incident, one has a good article for any wide-awake daily newspaper or sporting magazine.

474. **Recording Finishes of Races.**—The camera is now officially used on many race tracks, and especially at horse races, where large amounts of money are at stake, to give a perfectly accurate judgment of the “finish.” In these cases the camera is placed directly above the finishing line of the track, its angle of view including the whole width of the track.

475. A cord is stretched across the track, one end being attached to the shutter of the camera. The instant the leader touches this cord the shutter is released, making an instantaneous exposure—a perfect record on a sensitive plate of the positions occupied by all of the horses near the finishing line. A white chalk mark across the track, or a heavy white rope stretched high enough to be out of the way of the racers, enables a perfect and accurate judgment to be made of the positions of each contestant. Should a dispute arise at any time the photograph can be produced, which will settle any contention that might arise.

476. **Starts and Finishes.**—The “starts” of races are not so important as the “finishes.” Newspapers and magazines desire photographs of the finishes of the races.

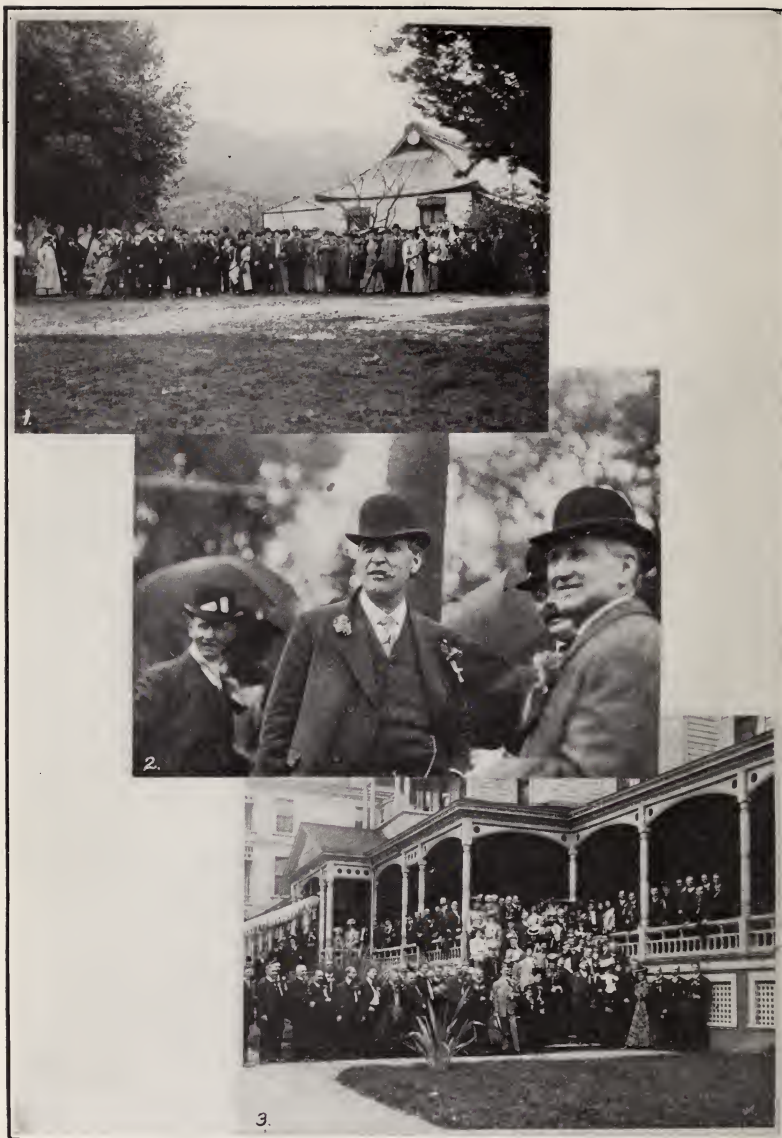
477. **Shot-Put and Hammer-Throwing.**—In making a photograph of the “shot-put” or the “hammer-throwing,” the shutter must be released almost at the instant the shot or the hammer leaves the hand. An instant may be allowed to elapse, however, in order to secure an image of the object being thrown, when it is at its height. An example of this is shown in Illustration No. 93, Figure 3.

478. **Pole-Vault and High-Jump.**—The contestant in the “pole-vault” or the “high-jump” should be photographed just as he clears the bar. Many times he will not perfectly clear it, but will knock it off the supports, in which case one should not waste a plate by making an exposure. Yet, this, at times, is a difficult matter to judge. If one has perfect control of his instrument and exercises



Illustration No. 93
 Athletic Sports—Reflex Camera Work
 See Paragraph 473

Photos by A. S. Dudley



Photos by A. S. Dudley

Illustration No. 94
 Press Photography—Reflex Camera Work
 See Paragraph 484

care, he will learn to judge instantly whether or not the athlete will clear the bar, and make the exposure accordingly. In both of these events the contestants make repeated trials, so long as they do not touch the bar. After each jump the bar is raised a certain height, and another attempt is made. One should watch each event closely, and after the majority of the contestants have been disqualified make a photograph of the remaining one or two who are yet capable of clearing the bar. The most important photograph to secure here is of the man who makes the record of the day. A good photographic record of a high-jump is shown in Illustration No. 93, Figure 4.

479. **High and Low Hurdles.**—In making photographs of hurdle races the camera should be placed on practically a level with the track, for this will tend to slightly exaggerate the height of the hurdles. In Illustration No. 93, Figure 5, is shown contestants clearing the final hurdles; when making photographs of these the shutter should be released at the instant the leader is clearing the hurdle.

480. **Obtaining Permission to Photograph.**—If you represent a magazine or newspaper it is a very easy matter to obtain admission to the field-meet and secure photographs of the various events. This is a very important matter to consider, for with the concession, and a ribbon or badge denoting such a privilege, you will be able to go into any part of the field—so long as you do not interfere with the various contestants—and secure your photographs from the best point of view obtainable. Always aim to become acquainted with the manager, or officials in charge, as well as those familiar with the various events and knowing the contestants. This will prove of assistance in selecting the important subjects, thus making your pictures more valuable.

481. **Data.**—By working in close touch with the management you can obtain accurate information regarding the different contestants, which will enable you to secure a fairly perfect record and full information regarding each of the exposures you make. Your plate-holders should be

numbered, and these numbers recorded in your note book. From the program you will be able to obtain the names of the contestants entered in the various events, and by carefully following these you will be able to judge very closely who will be the winners. This is important, for it is the photographs of the winners that are most valuable. The photographs alone would not be of as much value as when some data regarding the event is supplied with the picture.

482. **Market for Prints.**—Do not confine yourself to one publication alone, but send your prints and data to as many newspapers in your locality as possible. In fact, supply all editors whom you think would desire the prints. Even though the publication may have reporters and press photographers of their own on the field, if your results are superior to theirs, and if you get them in on time, you will stand a good chance of securing a sale for some prints, at least. It is, however, those publications which are not represented that you should exercise the greatest effort to supply with prints. It is advisable, when possible, to make arrangements with the editor before the event occurs, so that he may depend upon you to supply the material.

CHAPTER XXIII.

Press Photography.

Part IV.

Excursions, Conventions and Prominent Individuals.

483. Although for all phases of press photography the reflecting type of camera is the best to employ, a view camera may be used when photographing large groups which are arranged or posed expressly for the purpose of having their pictures taken, but the press photographer cannot carry more than one instrument; therefore, the reflecting type of camera is his all-around instrument, and for reproduction in the newspaper or magazine the 4 x 5 or 5 x 7 print is just as acceptable as a larger one. If large prints are desired it is possible to make enlargements up to 14 x 17.

484. The lens on all reflecting cameras being of the highest type—anastigmatic—it is possible to secure a perfectly sharp enlargement. If the press photographer has to hurriedly secure a photograph of a large group on level ground, he has many obstacles with which to contend. In making the photograph shown in Figure 1, Illustration No. 94, the press photographer had but a moment in which to make the exposure, but as this group contains very important personages it was extremely important that a photograph be secured. The picture was made when the party was taking a minute's exercise while the engine of their train was taking on water.

485. In securing the photograph reproduced in Figure 3, of the same illustration, more time was available in which

to see that each person occupied a position within view of the camera.

486. It is important, in making a photograph of large groups, to request the members composing the group to assume a position enabling them to see the camera. If this is done their faces will be seen. The most important personages should always occupy a position in the front of the group. Included in these two photographs are the members of the Commercial Organizations of the State of Washington, who made an extended excursion to California in 1906.

487. An excellent photograph of Honorable Albert E. Meade, Governor of the State of Washington, is shown in Figure 2, of Illustration No. 94. (He occupies a central position). The exposure was made during a rain shower, and unknown to the Governor. Photographs of this kind are always in demand by newspapers as well as monthly publications, which pay fully twice as much for them as for the conventional photographs made in a studio.

488. **Excursions.**—During the summer time, especially, there are, from even the smallest towns, excursions to lakes and various summer resorts, and the photographer who is ambitious and will accompany such excursions will reap a small harvest, providing he can secure a few excellent group negatives showing practically the whole party. It is not advisable to wait until you get home and have finished the pictures before you solicit orders. You should have a note-book with you, and take down the orders and receive full payment for the pictures immediately after having made the exposure. If you are known to the persons they will not hesitate to pay for their pictures in advance, and you can either mail or deliver them two or three days later.

489. During the excitement of the outing it is possible to secure fully five times as many orders as you would receive if you waited until people had returned home and partly forgotten the pleasures of the trip. In fact, if you did wait, it would be very doubtful whether you would sell

enough pictures to pay for the material used. One must have a good business instinct and not be at all backward about exercising his rights and letting the excursionists know that he is the *official photographer* on the excursion, and that it is to him they are to look for souvenir photographs.

490. **Publicity.**—If there is a program issued, or a special time-table printed by the Railroad Company he should try to have his name appear on the folder as *official photographer*. This will prove of valuable assistance. By making himself known in this way the people will immediately have confidence in him, and be perfectly willing to deposit the full amount asked for the pictures.

491. The price for such prints will depend largely upon the size of the plate used. It is better to sell prints from only two or three negatives and charge a good price for them, than to take orders from a half-dozen negatives, selling the prints very cheaply. There is much less work in finishing from the fewer number of plates, and the excursionists will appreciate them just as well as a larger number. They will seldom buy more than one or two prints, so one might as well charge a little more for each print and thus secure larger financial returns. If a 5 x 7 camera is employed it is customary to sell the prints for about 35 cents each, or if a set of three is made, charge \$1.00 for the set; 8 x 10 prints usually sell at 50 cents each.

492. In soliciting orders it would be a good policy to have a couple of excellent views on hand, which were taken on previous occasions, so as to give the people an idea of the class of work and the quality of the pictures which they may expect. Few excursions consist of less than two to three hundred people, and one should plan on securing orders from not less than 25% of these, which will give profitable returns for the day's work. The pictures should be finished and delivered at the earliest possible moment.

493. **Conventions.**—Quite often there are conventions of different characters, varying in interest to the general public. The more general or more national the nature of

the convention the greater are the possibilities of selling photographs to the larger daily and weekly papers.

494. If one can secure the exclusive right of making a photograph of the convention in session they should do so. As an example of the possibilities in this direction we show, in Illustration No. 95, a reproduction of a photograph made of the Strike Conference held in Scranton in the fall of 1902. This assembly was of national importance, and the results of the conference were eagerly watched for in all parts of the country, as it had to deal with thousands of miners. The result of this conference settled one of the greatest strifes between capital and labor that this country has ever experienced.

495. The photograph reproduced in Illustration No. 95 was the only one made of this assembly of noted lawyers and some of the most influential men of the United States. The first attempt at securing a picture was made on a Friday morning. The photographer had secured permission to make the photograph, with the understanding that the picture was not to be made until a certain hour, when the judge would make the announcement that a picture was to be made. The photographer had his 14 x 17 camera set in position, his flashlight apparatus properly located, and the machines loaded with powder, when to his dismay the judge dismissed the gathering for the noon recess and the various members arose and left the room. The error was due to the judge forgetting to announce that a photograph was to be made. The following Monday (November 17th) the photographer had typewritten slips handed to each member, stating that a photograph would be made at the noon recess, and that each person was requested to remain seated for a few moments. This time the judge did not fail to make the announcement; in fact, he gave a special recess at 11 o'clock, for the purpose of having the photograph made.

496. No difficulty was experienced in getting an excellent exposure. The plate was developed, a bromide print made, and the photographer immediately went to New York and sold a print to Collier's Magazine for \$75.00.



Illustration No. 95
Press Photography—"Strike Conference"
See Paragraph 494

Photo by T. E. Dillon



Photos by A. S. Dudley

Illustration No. 96
California Earthquake—Reflex Camera Work
See Paragraph 500

497. Taking into consideration that this was the only photograph made of the convention, it is a very easy matter to estimate that the returns to the photographer from this one negative were no small amount, for each member was anxious to get prints, which sold for \$5.00 each. The photographer could, however, have secured \$200.00 from Collier's as easily as he did \$75.00, for they wanted the picture and would have been willing to pay any price to get it.

498. Of course this opportunity does not come to everyone, yet if you will be on the alert there are opportunities presenting themselves every day, which, if taken advantage of, will bring returns of some kind to the press photographer. He is always sure of making his expenses, and often secures extra large commissions.

499. **Catastrophes.**—Railroad wrecks, floods, fires, earthquakes, and all similar catastrophes, due, to a greater or less extent, to the uncontrollable elements, make good subject material for the press photographer. The California Earthquake, which aroused such national interest, on the 18th of April, 1906, followed by the great San Francisco Fire, brought into the hands of many photographers a small mint of cash returns.

500. A few examples are shown in Illustration No. 96, the upper three of which were taken within an hour after the earthquake, and show the effects of the catastrophe on some of the costly buildings at Stanford University, which institution is located on the Peninsula, thirty-four miles south of San Francisco. These pictures, together with many others of a similar character, were immediately forwarded to eastern publications, as well as the coast daily papers, and the photographer received an excellent reward for his promptness in getting out the prints and placing them in the hands of the various editors.

501. The three lower reproductions in Illustration No. 96 are of scenes in San Francisco, photographed ten days after the earthquake, and show the deplorable conditions which existed there at that time. The middle print shows the ruins of the City Hall; the lower left-hand print shows a

view from Russian Hill looking toward the business center of the city; while the right-hand picture is a view on Market Street, which gives an idea of the appearance of what was formerly the main business portion of the city. All of the buildings were completely gutted by the fire, which burned this entire district.

502. **Conflagrations.**—In making photographs of fires, especially for newspaper reproduction, one must aim to secure the view which will show to best advantage the magnitude of the fire; in fact, the incidents connected with the fighting of the flames, the crowds collecting on the streets, and, in general, showing the excitement usually witnessed on such occasions. This would include the burning building and its surroundings, the fire-engines, the men at work and the on-lookers, etc. The lower reproduction in Illustration No. 97 shows the kind of a photograph that is desired. Compare this picture with the upper one, which is a closer view of the same building taken within a few moments of the former. In the one we have no appearance of life or excitement, the picture appearing dull and uninteresting, while in the other we show action and excitement, giving a general idea of the scene during the actual occurrence.

503. The negative should be developed at once and gaslight prints made and sent to the various papers, which will be printing extras regarding the fire within a short time after it starts. If the photographer works quickly he should have finished prints to deliver to the various publications within 20 minutes after having made the exposure. It is these prints that will be accepted. The person who procrastinates will never make a success at press photography. It is the alert and ambitious worker who wins.

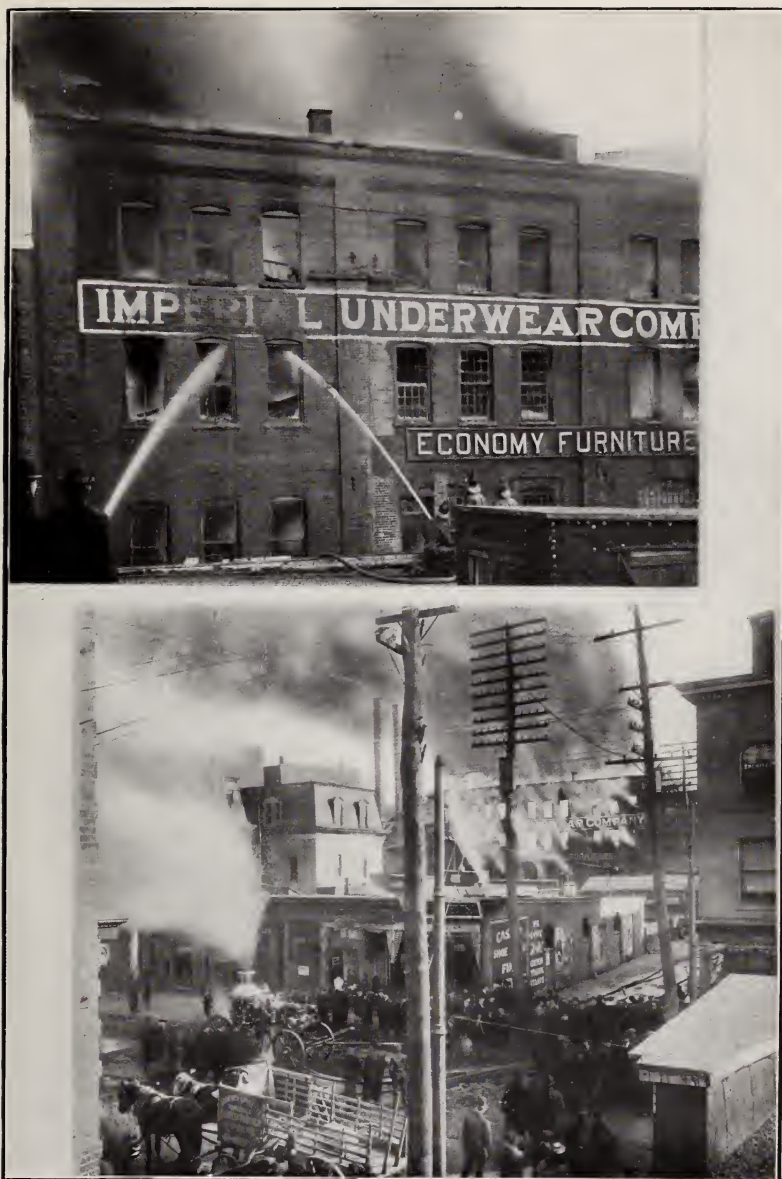


Illustration No. 97
Conflagrations
See Paragraph 502



Photos by A. S. Dudley

Illustration No. 98
 Engineering Construction—Columbia River Canal
 See Paragraph 504

CHAPTER XXIV.

Press Photography.

Part V.

Engineering Construction.

504. A glance through the various engineering journals will give one some idea of their photographic requirements. All of the various trade journals make certain demands upon the photographer, but one of the most lucrative fields that the photographer can enter is the one embracing engineering work. It is always necessary to have photographic records of the various stages during the progress of any large engineering project, such as the photographing of canals, canal locks, subways, tunnels, buildings, the erection and installation of all kinds of machinery, etc. To illustrate the handling of subjects belonging to this class, we show in Illustration No. 98 four different views of the canal built on the Columbia River to overcome the rapids at the Cascades. The illustrations are intended to give an idea of the manner in which a canal lock is operated.

505. The object of canalizing rivers is usually to overcome abrupt ascents, and several short canals have been constructed for this purpose on various rivers in the United States. The width of these canals is governed, to a certain extent, by the size of boats that are to pass through them. They are, however, wide enough to allow of two boats passing in them, so that one may go up and the other down at one filling of the lock.

506. Figure 3 is a view taken from the rear of a boat having entered the first lock, and shows one of the lower gates as it is being closed. Figure 4 shows a lock filled

with water, both of the gates having been closed, of course. The boat has been raised to the level of the water in the lock above. Figure 1 is a view from the front of the boat, showing the lower side of a closed gate, while Figure 2 shows this gate partly open, with a boat in the upper lock ready to come down to the lower lock.

507. This branch of commercial photography is inexhaustible, so far as the variety of subject material is concerned, for it is necessary to photograph all manner of building and engineering projects during the different stages through which they have to pass before completion. As many as twenty-five or thirty photographs are often required to show these different stages.

508. In Illustration No. 99 is shown the structural iron work of a large armory. This particular view was taken from the rear of the building, to give a general idea of the frame-work. At this stage it was possible—in fact desirable—to make six different views, for the work had progressed to different degrees in different portions, the masonry work on the front of the building having been completed. The engineers generally desire many detail photographs of different phases of the work which will show the methods of construction, and especially is this true when a new form of construction is being used.

509. The building of large reservoirs makes interesting photographs, and in Illustration No. 100 we show the completed masonry work which forms the dam of a large reservoir supplying water to a near-by city. The position chosen from which to make this view was one that shows the construction in a most perfect manner, and also gives an adequate idea of the dam and its general surroundings.

510. **Panama Canal.**—One of the greatest engineering projects of modern times, and one of special interest to every American, is the construction of the great Panama Canal across the Isthmus of Panama. When completed this canal will connect the Carribean Sea with the Gulf of Panama—or, in other words, the Atlantic Ocean with the Pacific—a distance of about 50 miles. This project has

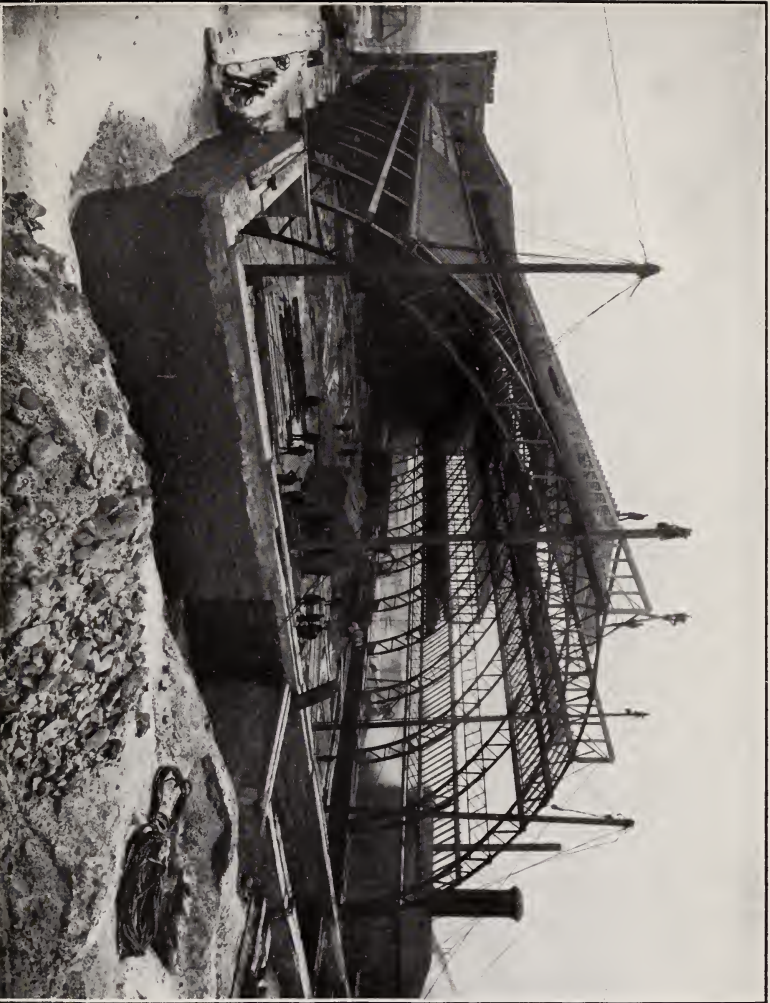


Photo by T. E. Dillon

Illustration No. 99
Engineering Construction—Structural Iron Work
See Paragraph 508

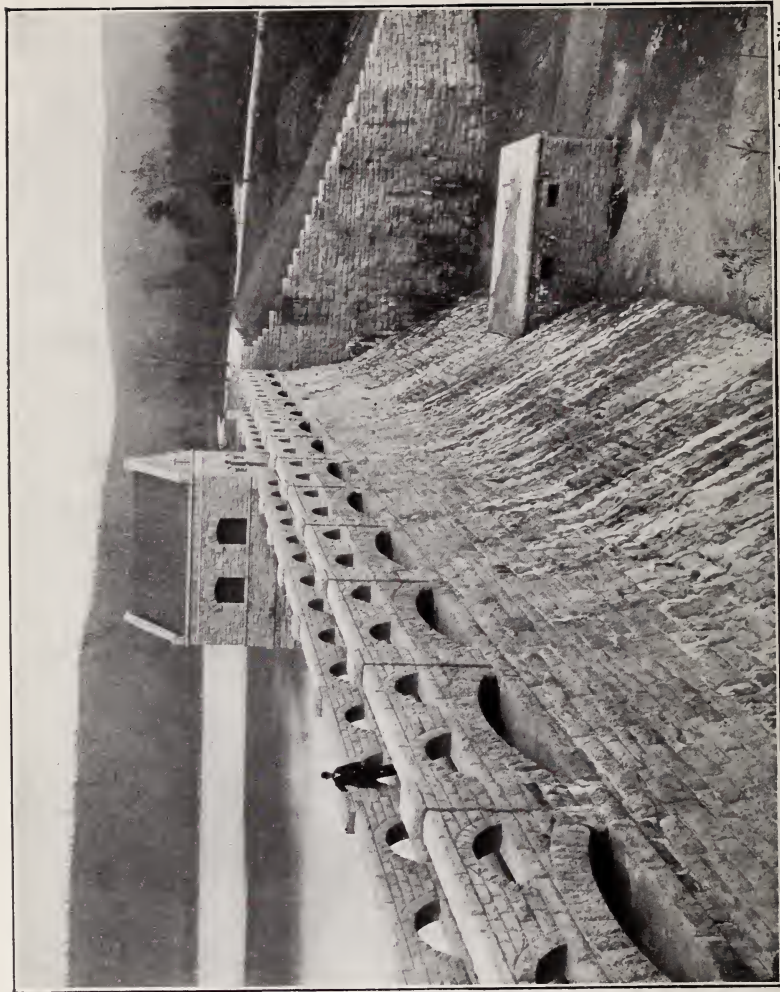


Photo by T. E. Dillon

Illustration No. 100
Engineering Construction—Reservoir
See Paragraph 509

received much attention during the past twenty-five years. Large sums of money were raised by a company, organized in France, to construct a sea-level canal at Panama. The actual work performed was very slight, as compared to the total amount required to complete the canal, and entirely out of all proportion to the expenditure. Finally, the affairs of the company fell into the hands of receivers, under very scandalous circumstances. The United States Government, in the meantime, appointed an engineering commission to examine the project, having received an offer from the French Panama Canal Company, who wished to dispose of their interest in the project, for forty millions of dollars. The matter was finally considered by Congress and terms agreed upon, which gave the United States full possession of the Isthmus of Panama.

511. Accurate reports must be sent, by the engineering officials working on the Canal, to the head of the United States Government, and it is, therefore, just as necessary to have official photographers as regular constructing engineers. Thus it will be seen that photography plays an exceptionally important part in this particular instance.

512. In addition to these, press photographers are sent to the Canal Zone, from time to time, to secure photographs and information for the magazines they represent. The photographs we have reproduced in the accompanying illustrations are of the type the press photographer would obtain.

513. In Illustration No. 101, Figure 1 shows the Culebra Cut as it appeared in June, 1906. This cut is about 11 miles from the city of Panama, which city is located on the west side of the Isthmus. Figure 2 is from a photograph of Bas Obispo Cut, looking toward Colon, which city is on the eastern side of the Isthmus. This illustration shows a mountain of solid rock, which will have to be excavated for the Canal. Figure 3 shows the dirt cars, three deep, at Las Cascadas. The Canal is in the immediate rear. Figure 4 is from a photograph of a steam shovel working on the higher levels of the Culebra Cut. This steam shovel may also be seen in the distance in Figure 1.

514. In making these photographs it was the aim of the photographer to show to the best possible advantage the lay of the ground and the methods employed in getting out the dirt and rocks.

515. The photographs reproduced in Illustration No. 102 are scenes in Panama City. Figure 1 is a view of this city from Tivoli Hotel. Figure 2 is from a photograph of Central Avenue after the Isthmian Canal Commission had paved it. This shows the Spanish style of architecture, which prevails throughout the Isthmus. Figure 4 shows another section of this avenue during the Roosevelt parade in 1906. Figure 3 shows yards of the Panama Railroad at Panama City.

516. In Figure 1, Illustration No. 103, is shown a lot of old French machinery piled up at Empire. This is but a small part of the unused materials which were left by the French company when the United States purchased the Isthmus. Figure 2 shows the laborers in line for their pesos, at Ancon. Figure 3 is a mining gang at Pedro Migner, excavating for a lock site. Figure 4 is a general view of the Empire shops, at Empire City.

517. In Illustration No. 104, Figure 1, is shown a type of architectural construction used throughout the Panama regions, and which the American Government uses entirely for their employees. The building is constructed with large porches completely surrounding it, which porches are screened in so that it may be possible for persons to sit out in the fresh air and yet be protected from mosquitoes and other insects, which are very troublesome at times. The particular building illustrated in this figure is the penitentiary at Culebra, a double row of barb-wire being around it. Figure 2 is a tropical view showing the palms in the hospital grounds at Ancon. The house on the right was formerly the De Lesseps' palace. Figure 3 shows the native huts at Pueblo Nuevo. Figure 4 is from a photograph of a railroad flag station at Lirio. One of these stations is located at every turn in the road, in order to avoid collisions, for dirt trains from the Cut follow each other very closely.



Illustration No. 101
Engineering Construction—Panama Canal
See Paragraph 513

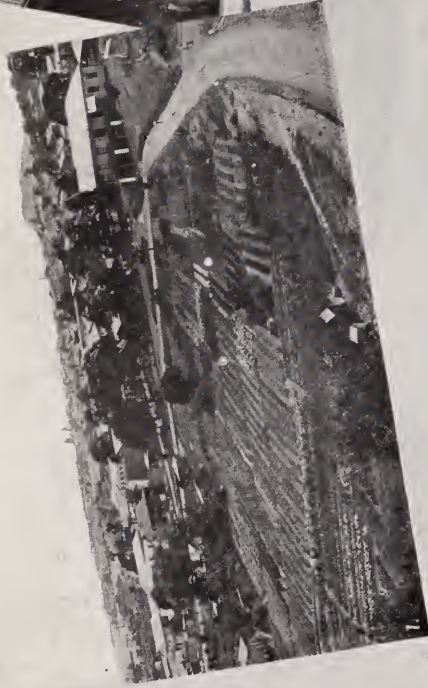


Illustration No. 102
 Engineering Construction—Panama City
 See Paragraph 515

Photos by Cyril B. McKenzie Empire. C. Z.



Illustration No. 103
Engineering Construction—Panama
See Paragraph 516

Photos by Cyril B. McKenzie, Empire, C. Z.



Photos by Cyril B McKenzie, Empire, C. Z.

Illustration No. 104
Engineering Construction—Panama
See Paragraph 517

518. This set of illustrations gives but a very slight idea of the great possibilities which present themselves to the photographer in this particular section of the world. The material for the press photographer is unlimited, yet it is necessary that care be taken to secure the most interesting and the most typical views. There are so many new and extraordinary scenes that it is possible to waste dozens of plates and yet not secure a print which will be acceptable to publishers. The pictures must in themselves tell the story to a great extent. The manuscript which accompanies them should deal simply with definite data which cannot be told in the photograph.

519. Pictures such as these just described, accompanied with a little data somewhat after the style of this chapter, for the compiling of a story, is what the papers want and are willing to pay liberally for. The more action and typical views one can obtain the more interest the pictures will have.

CHAPTER XXV.

Stereoscopic Photography.

Introduction.

By L. J. R. Holst.

520. Nature has equipped mankind with two eyes, which enables him to observe and judge the distance between objects, as well as the lateral dimensions of objects. Experience makes it possible to gauge distances accurately, but as soon as we must rely on the vision of one eye only, the faculty of judging distances, if not entirely lost, becomes materially weakened. The explanation is simple. We receive in our brain two different images of the same object, or objects, due to the different relative positions which our eyes occupy with relation to these objects, and their blending in the brain produces the impression of distance between the objects observed. This fact, upon which stereoscopic photography is based, can be proven by a very simple experiment.

521. Open a book before you upon the table and hold one of your fingers, or any other object which will not entirely hide the book from view, about midway between the book and the eyes. Now, first close the left eye and observe which part of the page is hidden from your view; then close the right eye, and observe that when viewing with the left eye a different part is obscured. Repeat this experiment, bringing the finger nearer to the eyes. You will have observed that the distance between the parts of the book that are covered with the finger increases the nearer the finger comes to the eyes, and also that it is quite easy to see with both eyes, not only the finger, but

also *all* of the book, whereas the finger hides the greatest part of the book when looking with one eye only.

522. These apparent inconsistencies are conciliated in the brain, which through life-long training, has learned that they are caused only by the different distances which objects are from our eyes, and then makes us observe their distance. The fact that young children will reach for objects that are entirely out of their reach shows that they have not yet learned to properly combine the vision of both eyes, which moreover explains their frequent unintentional squinting.

523. These remarks will help us to thoroughly understand the principle of stereoscopic photography, which is to first produce pictures such as each eye forms of a view, and then to arrange them for viewing so that they will blend and, by their blending, produce the sense of distance or space. We need the stereoscopic camera to produce the picture and the "stereoscope" to view it.

524. **Stereoscopic Cameras.**—There are a few devices in existence whereby the two stereoscopic images of a view are obtained by means of one lens only, but they offer no practical advantages over the usual two lens cameras, and therefore are only used where the twin lenses are not at hand.

525. There are mainly three different sizes of stereoscopic cameras in use in this country, viz., $3\frac{3}{4} \times 7$ inches, 5×7 inches, and 5×8 inches. Some manufacturers have made smaller sizes, which have met with a great demand from amateur workers; but views made for sale are, without exception, both here and in Europe, $3\frac{1}{2} \times 6$ inches, which dimension must be considered as a standard, and from which we conclude that the 5×8 -inch cameras are unnecessarily large, and that the 5×7 -inch cameras are most desirable, owing to the ease with which plates of this size can be obtained everywhere.

526. It should be plainly stated than in stereoscopic photography the actual size of the picture, or of any object in the picture, is of very secondary importance, as the

observance of a proper relation between the taking and the viewing lenses makes it possible to produce the impressions of large and even life-size objects, from very small views.

527. The next point of importance is the most desirable distance at which the lenses should be placed. Some cameras permit of the adjusting of this distance from $2\frac{3}{4}$ to $3\frac{1}{2}$ inches, but in actual practice this adjustment is of very little or no value, and it is most convenient to place the lenses at the standard distance of $3\frac{1}{4}$ inches from center to center. This is recognized to be the standard distance by all manufacturers of stereoscopic between-lens shutters, and is in proper harmony with the dimensions of the finished picture, which will appear as standing out behind its mount, and produces the effect of looking at the view through an opening or window, thereby materially enhancing the plastic effect. A lesser distance between the lenses tends to destroy this effect, and a greater distance would prevent the proper blending of images in the great majority of stereoscopes of standard manufacture, and also exaggerate the effect of distance beyond the desirable limits.

528. The wide front board necessary to accommodate the two lenses leads many manufacturers to fit their stereoscopic cameras with a front board of equal width as the back of the camera—a very satisfactory design insuring great rigidity. The internal lateral partition is frequently removable, in which instance the camera is equally useful for ordinary single-lens exposures.

529. The necessity of the greatest possible sharpness of definition from the nearest foreground to the furthest distance makes ground-glass focusing highly preferable over reliance on a focusing scale, as only very few operators can “divide” the focus with certainty without seeing the actual image projected by the lens. For this reason the most successful hand-camera stereophotography is done with reflecting cameras. (See Illustration No. 105.)

530. **The Lenses.**—The majority of photographers have only one set of stereoscopic lenses and must use

these for the greatest possible variety of views. This makes the selection of a focal-length from $4\frac{3}{4}$ to 5 inches most desirable. As such lenses embrace only a relatively small angle of view on the finished picture they are not very desirable for interior views, for which a focal-length not exceeding $3\frac{1}{2}$ inches should be selected. It is, of course, of the greatest importance that a set of stereo lenses should be accurately matched; that is, that their focal-lengths be as nearly alike as possible—a difference not exceeding 1-250 of an inch, or 1-10m/m, is allowable.

531. **Testing the Matching of Lenses.**—If a pair has not been matched by a reputable firm of lens manufacturers they can be tested by a comparison on distance and on close-by objects. If a pair matched properly on a distant view, it would still be possible that a difference in focal-length exists, but is compensated by a corresponding difference in the setting of the glass in the mounting; or, in other words, if we should have one lens of $4\frac{3}{4}$ inches focus and one of $4\frac{1}{16}$ inches, they may still show a sharp distant view at the same adjustment of the lens board when the shorter lens should also be set $\frac{1}{16}$ inch deeper in its mounting. This will, however, be at once noticeable by focusing the same pair of lenses on an object only 2 or 3 feet away. The difference in sharpness will become visible and we can decide with certainty that such lenses do not match.

532. This rule works with equal accuracy in the opposite way, and may thus be used to determine if matched lenses are set equally deep in their mountings. Apparently they might fail to match and one would require to have its ring or flange sunk in the lens board in order to focus sharp with the other on distance. If after having done this the lenses will give equally sharp definition on nearby objects, they match optically and will be serviceable for stereoscopic purposes.

533. As to the speed of such lenses, practice demonstrates that a maximum opening of f. 6.3 or f. 6.8 is ample for all purposes, and faster lenses can only be recommended



Illustration No. 108
Stereoscopic Camera—Simple Form
See Paragraph 538



Illustration No. 105
Stereoscopic Reflex Camera
See Paragraph 529

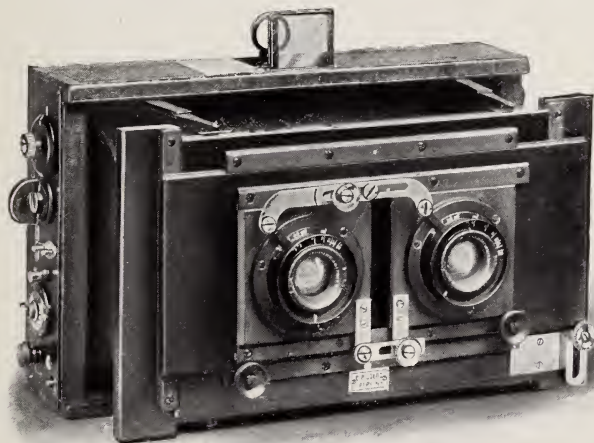


Illustration No. 109
Stereoscopic Camera—Goerz Anschütz Folding
See Paragraph 539



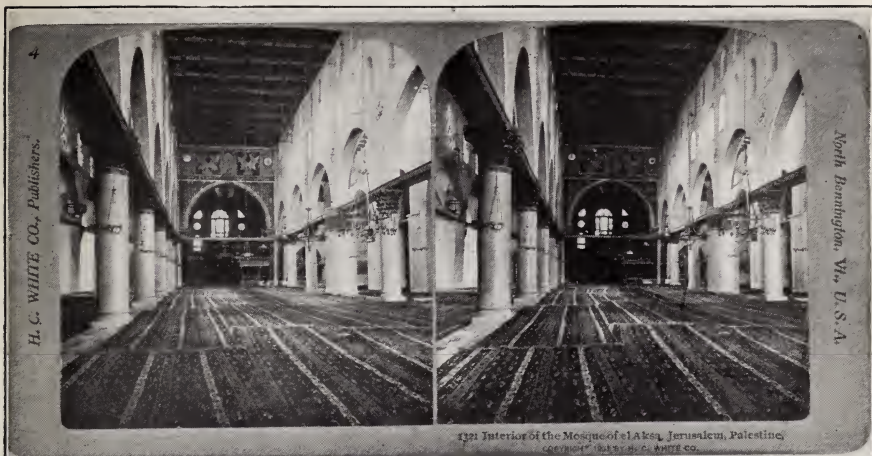


Illustration No. 107
Stereoscopic Views
See Paragraph 535

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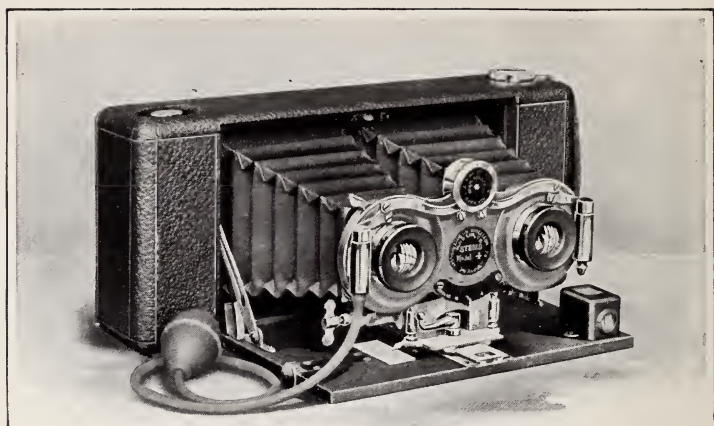


Illustration No. 109a
Stereoscopic Camera—Kodak
See Paragraph 539



Illustration No. 112
Self-Transposing Printing Frame
See Paragraph 556

for portrait work. Larger openings reduce the depth of focus too much, and especially in stereoscopic photography depth of focus is of the utmost importance for the final result. Soft definition destroys the plastic effect of the image—sharp, clean-cut negatives yield the best results.

534. For outdoor work it is often desirable to use lenses of longer focal-length than indicated for the all-around set of $4\frac{3}{4}$ and 5 inches. When the principal object is at a distance which precludes sufficient detail with this focus, longer lenses should be used, and better results will be obtained with a focus of $6\frac{1}{2}$ or 7 inches, under the condition, however, that some object in the nearer foreground be included in the view, as otherwise the effect of distance would be lessened and the picture made to appear flat.

535. In Illustrations Nos. 106 and 107 are presented stereoscopic pictures made with lenses of different focal-lengths. Fig. 1, Illustration No. 106, The Matterhorn, being a distant view, for the best results would require a 7-inch lens. Fig. 2, Pompeii, and Fig. 3, the Alexander Bridge, in Paris, are good examples of the use of normal-focus lenses for outdoor views, which is about $4\frac{3}{4}$ inches. Fig. 4, Illustration No. 107, Interior of the Mosque of el Aksa, in Jerusalem, is a good example of wide-angle interior views made with lenses of $3\frac{1}{2}$ -inch focus. Fig. 5, The Grand Hall, in Palace Hotel, is an example of interior work made with normal-focus lenses, and shows the very restricted angle included in such views.

CHAPTER XXVI.

Stereoscopic Photography.

Detailed Instruction.

536. **Stereoscopic Camera.**—The stereoscopic camera in its simplest form consists of a partitioned box with a pair of perfectly matched lenses mounted on its front board in a fixed position. The lenses should be fitted with stereo shutters, both shutters acting simultaneously.

537. The camera should be equipped with a rising front; also a swing-back or swing-bed, in order that true and perpendicular lines may be obtained. A dividing partition inside of the camera will be necessary to prevent the images from fogging each other.

538. In Illustration No. 108 is shown a simple form of stereoscopic camera, size 5 x 7. It is equipped with a Wollensak shutter and symmetrically matched lenses. The camera possesses a swing for either back or bed, a removable front board, and a hooded, brilliant finder. The stereo division inside of the bellows is on an improved roller principle, and when the camera is closed or opened the division rolls and unrolls automatically. The stereo division can be detached from the camera at will, when it is desired to use the camera for taking 5 x 7 pictures instead of stereo pictures.

539. In Illustration No. 109 we present the Goerz-Anschütz Folding camera, which is adapted to stereoscopic photography. This camera is provided with an adjustment by which the separation of the lenses can be varied—a point of some importance for the most accurate work. With this camera the stereoscopic division can also be removed and one of the lenses brought facing the center of the

plate. By this means the camera which takes a plate $3\frac{1}{3} \times 7$ is rendered available for extensive panoramic views. Where it is intended to use the camera for both stereoscopic and panoramic view work, it should be fitted with anastigmat lenses. They, having great covering power, may be used single or double. In Illustration No. 109a is shown a roll film Kodak constructed for stereoscopic work.

540. **Commercial Outfit.**—To make a business of stereoscopic photography one should be equipped with a square-bellows stereo-camera, fitted with focal-plane, as well as between-the-lens, shutter, both arranged so that either may be used independent of the other. They should also be provided with lenses of different focal-lengths, from $3\frac{1}{2}$ to 10-inch focus, the latter to be used when working at great distance from the object and the former for working in confined places, interiors, etc.

541. **Choice of Lenses.**—Very good commercial work may be made with the ordinary rapid rectilinear lenses, using two $3\frac{1}{4} \times 4\frac{1}{4}$ lenses for this purpose. Where the most accurate results are to be obtained, however, the corrected or anastigmat lenses should be employed, such as the Goerz Dagor f. 6.8; Bausch & Lomb Zeiss-Tessar IIb, speed f. 6.3; Dallmeyer Stigmatic Series II, speed f. 6; Ross Homocentric Series C, speed f. 6.3; Voigtländer Collinear, Series III, speed f. 6.8, or Cooke Series III, speed f. 6.5. Any of these types of lenses are sufficiently rapid and may be used for speed work or time exposure.

542. These lenses are selected for their covering power, depth of focus, and relatively large working aperture. The smaller the working aperture of lenses the easier and more accurately can they be paired. Little or no difficulty is experienced, therefore, in matching lenses of the rectilinear type, while lenses having a speed of f. 6.8 or f. 6.3 must be selected with great care, and lenses having apertures of f. 5.5, f. 4.5, etc., are matched only with difficulty. In addition to this the depth of focus of the most rapid lenses is so very slight that they must be stopped down in actual practice so their theoretical speed is of

no value and the length of required exposures is as great as lenses listed to work with a smaller aperture.

543. **Pairing of Lenses.**—When two lenses are employed it is essential that they be accurately paired, both with regard to focal-length and quality. If it is found that one is more rapid in its action than the other, which is sometimes the case, this inequality may be balanced by using a smaller stop with the more rapid lens.

544. Where one set of lenses is employed for all your stereoscopic work, a normal-angle lens of from $4\frac{3}{4}$ to 5-inch focal-length should be selected. Distorted perspectives will be the result if wide-angle lenses are used for architectural subjects, the nearer objects being exaggerated in size in comparison with those in the distance. On the other hand, the stereoscopic effect is reduced considerably if a narrow-angle or long-focus lens is employed, for the objects near at hand are not included in the picture, and it is these near objects which assist very materially in producing the strongest stereoscopic effect. The narrow-angle or long-focus lens is suitable principally for long distance work, where it is impossible to work close to the object. By using lenses of a long focus—in other words, employing lenses intended for larger-sized work—you obtain a larger image on the same size plate.

545. For landscape work a lens having considerable depth of focus will be required. The lens which will give the best single picture, free from optical defects, is desirable for stereoscopic work. One point in favor of stereoscopic photography is, that pictures lacking in interest as a single photograph possess quite a charm when viewed stereoscopically, and for this reason the beginner will often secure excellent results with inexpensive lenses.

546. **Stereoscopic Photographs with One Lens.**—Although there are certain disadvantages which accompany the use of one lens, there are many ways of making the dissimilar pair of pictures with the ordinary hand camera having only one lens. If a 5×7 camera is used the lens may be mounted on a front board, which may be slid horizon-

tally from one side to the other, between the two exposures. In this case a partition in the camera will be needed.

547. Another method is to use a 4 x 5 camera, making but one exposure on a plate. For this method a special tripod top should be employed.

548. A very simple form of stereoscopic tripod head is shown in Illustration No. 110. This is attached to the tripod at the center B, and the camera fastened in either notch A or C, and removed between exposures to the opposite end.

549. An improvement on the above apparatus, so far as the work of accurately shifting the camera between the two exposures is concerned, and also the effecting of the change with the least possible loss of time, is shown in Illustration No. 111. The camera is fixed on the block

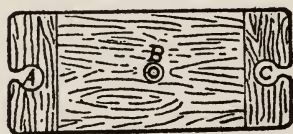


Illustration No. 110
Stereoscopic Tripod Head—
Simple Form
See Paragraph 548

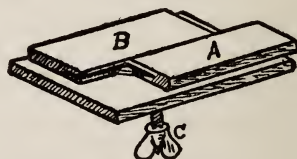


Illustration No. 111
Stereoscopic Tripod Head—
Adjustable
See Paragraph 549

A, with the lens pointing over B. When an exposure has been made the camera, which is on block A, is shifted to the left until the two blocks again touch each other, and then the second exposure is made on another plate. The parallel movement is regulated by a pair of links fastened to the two blocks. This attachment is fastened to the tripod head at the center, in exactly the same manner as the camera is ordinarily attached.

550. The single-lens camera, of course, has its drawback. For example, when making a picture of a street scene, or any view where there are moving objects, and where the exposure must naturally be rapid, the result produced is far from satisfactory. The objects that were moving would not have the same attitude or be in the same

location in the second exposure as in the first. Where the twin lenses are used both exposures would be identically the same. Therefore, even for the amateur the single lens is not recommended for stereoscopic work, but may be used in case of emergency.

551. For those who expect to do much stereoscopic work, and yet do not want to invest in an expensive outfit, we would recommend the purchasing of a square-bellows 5 x 7 camera, made for use with twin lenses. The same camera can also be used with a single lens; all that will be required is an extra front board and an extra lens for 5 x 7 work.

552. **Selection of View-Point.**—The accuracy of the selection of point of view for stereoscopic work is even more important than for regular view photography. The stereoscopic picture to be interesting must have objects in the immediate foreground, to give a stereoscopic sense of relief or distance, and to lead the eyes into the picture, at the same time breaking up the monotony of plain space.

553. With the regular stereo camera, where the lenses are mounted stationary, the best stereoscopic effects are obtained where the nearest object is not farther away than fifteen feet, and in many cases, especially interior views, small objects within six to ten feet of the camera assist materially in balancing the picture.

554. **Lighting and Exposure.**—The lighting of all subjects intended to be reproduced and to form stereoscopic pictures should be soft, rather than hard and contrasty. The high-lights must not be so white that they will produce a chalky effect, nor must the shadows be so dense that no detail is obtainable. As a general rule, the most satisfactory pictures for the stereoscope are those which have been taken in a subdued light and a fairly long exposure given the plate. The amount of exposure for different subjects is exactly the same as when using the lens singly.

555. **Development.**—Stereoscopic exposures are treated in exactly the same manner in development as the ordinary exposure, but you must develop for softness and detail.

When two separate plates are employed for stereoscopic pictures, one must aim to secure perfect uniformity, bearing in mind that a thin negative yields better prints than a dense one. Aim to secure detail in the shadow portions before the high-lights become too dense. A diluted pyro developer or the *Universal Developer* given in Volume II are best suited for developing stereoscopic negatives.

556. **Printing.**—In making stereo prints it is necessary to transpose either the negative before printing or the trimmed prints before mounting. The reason for this is, the lens throws an inverted image on the film; therefore, when the negatives are viewed right side up, the one on the right is from the negative made by the left lens. To correct this the negatives or prints must be transposed. This may be done in either of three ways: First, by making one solid print from the negative as it is, then cutting the two prints apart, and finally, transposing before mounting. Second, by cutting the negative in half and, after transposing the two views, mounting them on a piece of plain glass. The edges are fastened with binding tape and the print made on one solid sheet of paper. Third, by means of the stereo self-transposing printing-frame, manufactured by the Blair Camera Company, and made to hold only films. By means of this printing-frame the cutting of the negatives is done away with. The accompanying illustration, No. 112, of this frame is self-explanatory. This frame is made for developing papers only, to be used in connection with film negatives $3\frac{1}{4} \times 6\frac{1}{2}$, and is not adapted for glass plates, as they come in different thicknesses.

557. As the stereo paper may be procured already cut for use, the trimming of the prints may be done away with entirely and the one solid print mounted on the stereo card.

558. **Depth of Printing.**—Stereoscopic pictures, when made on printing-out paper, should be printed to a good depth. A light print when viewed through a stereoscope will lack in depth and roundness, and there will appear little or no relief. While we do not recommend flat prints, want-

ing in vigor, they often look the best through the stereoscope. The prints should be full of detail. Avoid contrast. When printing on gaslight or developing papers, extreme care must be taken to see that both prints are given the same exposure. When printing on printing-out paper, be careful to print both sections to the same depth. For instruction on toning and manipulation of all papers see Volume IV.

559. **Trimming.**—Where much stereo work is being done, the paper should be purchased already cut the exact size, so that no matter whether you use the self-transposing printing-frame or if you transpose the negative before printing, or even if you print direct from the negative and transpose the prints afterward, the accurately cut sheets can be used just the same. In the latter case all that is required is to separate the two prints and transpose them in mounting.

560. Where stereo prints are only made occasionally and untrimmed sheets of paper used, then considerable care must be exercised in the trimming. First, determine the base line. A suitable size for the individual prints is $2\frac{1}{2} \times 3\frac{1}{2}$. Provide yourself with a glass form this size. If oval prints are preferred, a celluloid form should be used. On one side of the form draw a vertical and a horizontal line, crossing exactly at the center. These lines will enable you to readily place the film in proper position when trimming.

561. **Position of Cutting Form.**—Place the prints to be mounted face up on a sheet of plate glass or zinc, and lay the glass form with the etched lines in contact with the print. The vertical line on the glass should be parallel to the vertical lines in the picture, such as the sides of a building, while the horizontal line should be made to intersect corresponding points in both pictures. Unless you do this the two different pictures will be on different planes, and not on a level with each other—an error that will make it difficult to combine the two pictures when they are viewed in the stereoscope—for when the subject is exam-

ined it should present the appearance of relief, with all the composition lying beyond the margins of the print. To obtain this effect a little more of the subject should be kept on the left-hand edge of the right picture, and a little more on the right-hand edge of the left picture.

562. **Mounting.**—Where prints are made direct from the stereo negative, and are not transposed in the printing, then before the double photograph is separated you should mark the pair of prints in some way so as to be able to match them in the mounting. The left end prints should be marked on the back with the letter L, and the right end with the letter R. They may then be numbered in pairs and cut apart and trimmed, and in mounting be guided by the letters and numbers on the back.

563. If prints should be mounted without reversing them, the effect known as *pseudoscopic* will be produced. and when the pictures are examined through the stereoscope, objects which should occupy a remote position appear in the foreground, while objects which should stand out in the photograph tend to recede. Where the negatives are cut in two and transposed before printing, then one sheet of paper may be used, covering both negatives, and prints from such negatives may be mounted without cutting. The best stereoscopic pictures are made, however, where the prints are made from the original negative and transposed in the mounting, supplying two separate prints.

564. **Paper to Use.**—Any paper may be employed that will give good, clear, sharp detail—either printing-out or gaslight papers. Where stereoscopic pictures are made on a large scale, usually developing papers are employed, and the cheapest pictures are made where both images are printed on one sheet, while for the best work they may be printed from the original negative in one sheet and cut apart and transposed in the mounting. Usually where gaslight papers are employed for best work the glazed surface papers are used and the single die cut sheets are employed. These die cut sheets are supplied by most all manufacturers of paper.

565. **Stereoscopic Mounts.**—Stereo mounts are usually supplied in three sizes, square or round corners, and in a variety of colors—the buff, white and Queen's gray, however, are the most popular. The size of the mounts are usually $3\frac{1}{2} \times 7$, 4×7 and $4\frac{1}{2} \times 7$. The size generally used is $3\frac{1}{2} \times 7$. Many large concerns who are making stereoscopic pictures on a cheap scale are using developing papers, cutting their negatives in two, transposing them on a piece of plain glass, masking the negative, and instead of mounting the prints they are printed in one sheet and backed with gelatin backing paper, the backing paper supplying the mount. For instruction for backing prints see Volume IV.

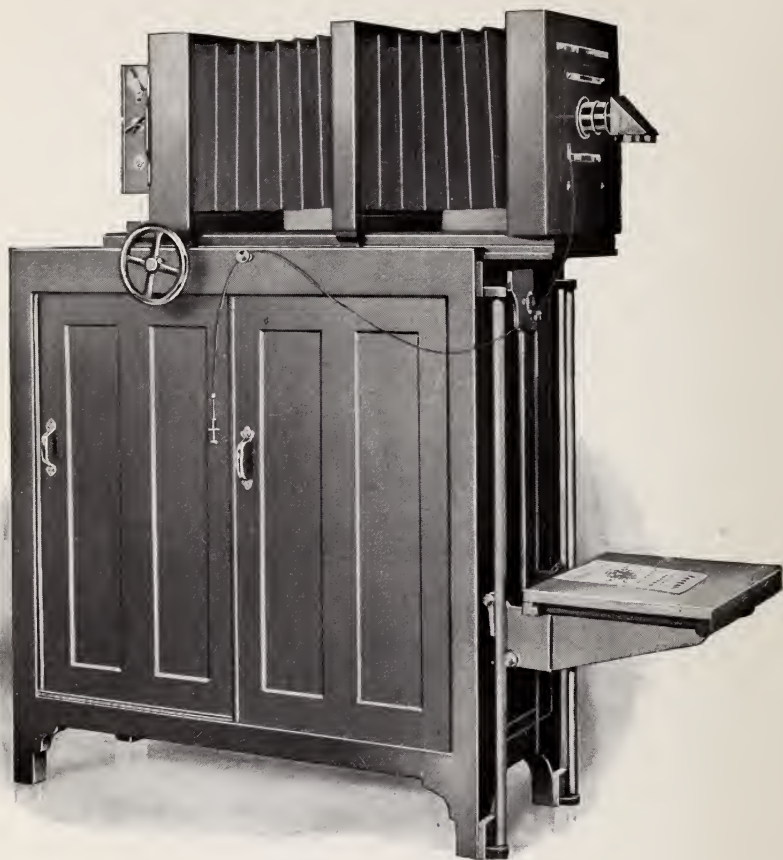


Illustration No. 113
Record Outfit
See Paragraph 578

CHAPTER XXVII.

Photographing Legal Documents, Insurance Applications, Etc., by Means of the Record Outfit.

566. The use of Photography for quick record work has in the past been somewhat restricted, owing to the double process involved; *i. e.*, the first making of the negative and then from the negative making the print. The production of sensitive papers, which permit of direct exposure, led to the invention of an apparatus by means of which reproductions may be made direct on the sensitized paper, requiring no special photographic skill to operate. In fact, with a little care anyone can operate the machine. For this reason this apparatus has been of great help to large concerns, such as insurance companies, law offices, publishers, etc., who require exact records of applications, agreements, contracts, deeds and reproductions of pages of books, copying of plans, etc., for by means of this apparatus accurate records are obtained and any possible error avoided. In addition to these advantages there is also a saving in clerical work.

567. **Use of Apparatus for Detecting Forgery.**—While this apparatus is now universally used by all large concerns for different kinds of record work, it is also used in the detecting of forgery. For example: Where a section of manuscript or document has been erased, the photographic copy will indicate it. Inks used at different ages photograph differently. Therefore, where an addition has been made this addition may be detected by the appearance of the photograph, which will show a silver deposit of different density from that of the original.

568. The record outfit was originally constructed for use in life insurance offices, in large law offices and in

Governmental work, where exact duplicate fac similes of documents are required for filing and for use in the courts, etc.

569. Since the new laws governing life insurance companies have gone into effect, it becomes necessary to supply each policy holder an exact copy of the original application. The old method of making copies by hand has become very expensive, requiring a corps of clerks for the purpose; and, besides, the old method has proven inadequate, for the reason that there is some danger of error in the copy, whereby with the new method the copy is quickly and accurately reproduced by photography, with a positive assurance of accuracy and a great saving in expense.

570. Photographs are taken directly on what is called "Insurance Bromide Paper," which is made up in rolls 100 feet in length and 11 inches in width. Each roll is mounted upon a reel, and is exposed in the camera in much the same manner as a film of an ordinary pocket camera. As it is reeled off the paper is automatically perforated every 7 inches, and when as many exposures as may be wanted have been made, the reel holder is removed from the camera and taken into the dark-room, where the photographs are separated by the perforated marks, and developed in the usual manner.

571. The light for illuminating the application is furnished by two Aristo arc lamps, one on each side of the camera, and a little in front of it, so that they throw a strong light upon the application, which is placed upon a table or stage directly beneath the lens. To this lens is attached a prism, which makes the application appear inverted on the ground-glass, and, consequently, not inverted when reproduced on the bromide paper. The image, however, is in negative form—the black letters reproducing white, etc.

572. The time of exposure given to each photograph averages about six seconds, and as the replacing of the application only occupies a similar time, five photographs

may be made per minute. The developing, fixing, washing and drying takes longer, of course, but the prints are developed in batches of ten or more at a time, and forty or fifty photographs are frequently turned out in an hour.

573. The print is developed with gaslight paper developer, the time consumed being less than one minute, after which it is placed for ten minutes in the fixing, or hypo, bath, and then for a similar period in a tank, or tray, supplied with fresh running water.

574. The print, which is now permanent, is hung up and dried before an electric fan; then trimmed and fastened to the corresponding policy.

575. The original application, after being exposed, is sent to clerks, called the "backers" (policy writers and checkers) and by the time it comes back from them the photograph of it has been finished.

576. The Mutual Life Insurance Company, of New York, were perhaps the first company to install this method. They have found it decidedly superior to the old method of copying applications by hand, as there can be no errors in the copy, for the photograph is an absolute reproduction of the original application. This is an important feature.

577. Many times copies are wanted of old policies, as well as applications, forms of which have now become obsolete; these were formerly typewritten, but now they are photographed, as are also policies held for loans by the company, check accounts, letters and other documents.

578. **The Outfit.**—The outfit, as pictured in Illustration No. 113, is manufactured by the Eastman Kodak Company, and consists of a long bellows camera; a cabinet; an adjustable stage (copying-board); a special insurance bromide paper roll-holder, carrying 100 feet of 11-inch paper; a No. 6 Plagimat lens (13-inch equivalent focus) and a 3-inch prism fitted to the lens. In addition to the roll-holder, a ground-glass carriage and single sheet-holder, with a full set of nested kits accommodating from 4 x 5 to 11 x 14 paper, are included; also two Aristo arc lamps, which supply the illumination.

579. The base, or the support, for the camera is a large cabinet, which is provided with shelves for storage. The camera is arranged on this cabinet and slides bodily on a track, controlled by a rack and pinion, operated by a hand wheel on the side.

580. The lens attached to the camera is fitted with a prism, so that the printed matter is photographed right side to. The prism is necessary to avoid the inversion of the image, for while the reproduction is, practically speaking, a negative, yet it is opaque, and we do not look *through* it as we would a negative, but *at* it as we would a print. The lens is provided with a regulation shutter for exposing.

581. The copy is attached to a stage, which slides up and down, and is controlled from the back of the camera by a large hand wheel, thus permitting of the raising or lowering of the stage from the back while focusing.

582. The apparatus is provided with a plate-holder which will take plates or paper, thus enabling one to use the camera without the prism as a straight copying camera, when desired.

583. **Installing the Record Outfit.**—The record outfit, with lamps in position, will require a space of about 8 x 10 feet, allowing for ample room to pass around the machine. The apparatus itself is about 72 inches long, and 50 inches high to the top of the cabinet. The stage or platform carrying copy is 24 inches long, and the lamp hanging on either side of this would make the distance from center to center of lamps about 42 inches, so that a floor space 8 x 10 feet will give ample room to pass around the machine. An ordinary room 12 x 14 or 14 x 16 feet is amply large for the operating of the machine, and, in addition, will allow sufficient space for the dark-room and drying racks.

584. **Installing the Machine.**—The machine should be installed in one corner of the room, at a distance of 2 feet from both the side and the end walls. See Diagram No. 114. The Aristo lamps are suspended from the ceiling, at points 42 inches apart, dropping on each side of the

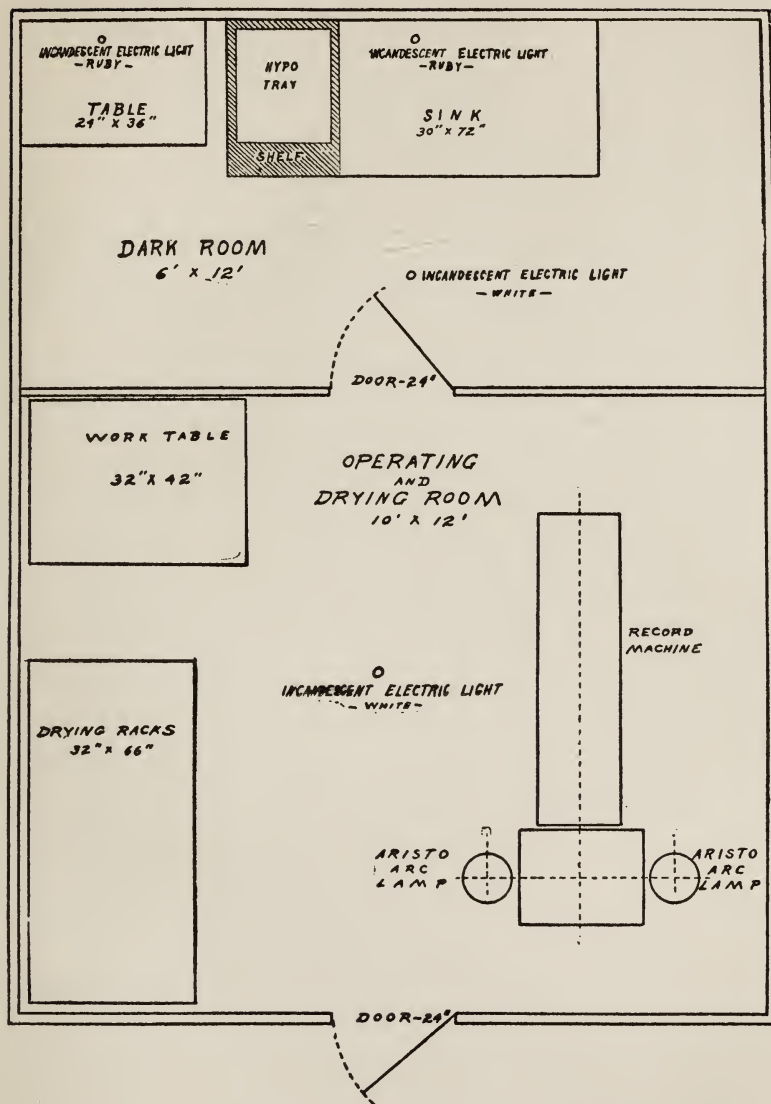


Illustration No. 114
Record Outfit—Floor Plan of Room
See Paragraph 584

stage or platform. When ordering lamps for this machine, state what current the lamps are to operate on, giving voltage, and in case of alternating current state the voltage and frequency. Complete instructions for installation accompanies each lamp, so that any local electrician may easily install it.

585. It is advisable to suspend the lamps by a cord through a hook and pulley in the ceiling, so that each lamp may be adjusted to any height desired. Usually a distance of 6 to 9 inches above the stage supplies the best and most even illumination.

586. **The Dark-Room.**—The dark-room may be made by partitioning off one end of the room, and should be large enough to permit a person to conveniently develop and wash the prints. A dark-room should not be smaller than 6 x 10 feet, and a liberal size sink built, with at least two water faucets. A sink 30 inches wide and 6 feet long will answer every purpose.

587. Three large trays 20 x 24 inches, and one tray 11 x 14 inches, will be required for developing, fixing and washing the prints. The sink should be fitted with wooden racks, upon which to rest the trays. Besides the above, you should have an ordinary table, at least 3 feet long, and a few shelves built over the end of the sink for holding bottles of developer, etc. A rack may be constructed underneath the sink, to hold trays when out of use.

588. **Drying Racks.**—The most convenient drying racks are the stretcher frames. Provide yourself with as many stretchers as you require, made of 1 x 2-inch pine, 22 x 36 inches in size. Cover these frames with thin muslin. An inch block should be nailed on top of the corners, and in the center of each screen, thus providing for air space between stretchers when stacked with prints. When ready for use, lay the first stretcher on a table (which should be provided for this purpose and located in the same room with the record machine) and raise the first stretcher above the table say 4 inches, to allow for a current of air to pass between table and screen. Fill the first stretcher

with prints and cover with another stretcher, and continue in this way until all are laid out to dry. A current of air from an electric fan will reduce the time required for drying to a few hours.

589. **Manipulating the Apparatus.**—With the bellows of the camera extended, the lens and prism in place, and the ground-glass attached to the rear of the camera, in place of the roll-holder, you are ready to begin work. First, place the copy, or application, upon the stage, directly underneath the prism. This space you should outline on the bed of the stage, so that all future applications may be placed in exactly the same position, thus making it unnecessary to focus each application. The prism is centered over the application by racking the camera bed attached to the cabinet, forward or backward; the racking is easily accomplished by means of a wheel at the side of the cabinet.

590. To hold the application flat, cover it with a sheet of plate glass; then step to the rear of the camera and observe the image on the ground-glass. The size of the image is adjusted by the raising or lowering of the stage. This adjustment is operated from the rear of the camera stand. The focusing of the image on the ground-glass is accomplished by racking the camera forward or backward. When the focus is once obtained for a certain size of work, there will be no need for re-focusing.

591. After obtaining a sharp focus remove the ground-glass and place the roll-holder in position. Be certain that the shutter on the lens is closed, then withdraw the slide of the roll-holder. Reel off enough sensitized paper for the first exposure. With lights working well, six seconds should be a sufficient exposure. After the first exposure, the shutter being closed, the exposed paper is reeled off, bringing an unexposed section in place for the next exposure, etc. When all applications have been photographed, insert the slide in the roll-holder and proceed to the dark-room to develop the prints.

592. **Removing Exposed Paper.**—First, begin by cut-

ting up the paper as perforated on the reel, each exposure being perforated automatically in the reel. Next, place the single sheets in a light-tight box or drawer until you are ready for developing. In the meantime, prepare the roll-holder again for further exposures, by attaching the end of the roll of paper onto the empty spool, and insert the slide to protect it from the light.

593. **Developing and Finishing.**—The exposed sheets should be developed, fixed, washed and dried without interruption. The developing-room, or dark-room, should be provided with three lights, two of which should be incandescent ruby, and the other may be of ordinary incandescent white light. If the developing is done over the sink, the two ruby lights should be arranged one at each end of the sink. However, if, as outlined, the developing is done on a table at the left-hand end of the sink, then one ruby light should be extended over the table and the other over the center of the sink.

594. The trays should be arranged in regular order. First, place your developing tray to your left, on the table, and next to it one of your larger trays, to be used for acid water after developing. In the left-hand corner of the sink arrange the hypo or fixing tray, and place the washing tray in the sink, next to the hypo tray.

595. The developer may be purchased either ready prepared, or can be made up by yourself. For developing and fixing formulæ see Volume IV. A large quantity of the developing stock solution should be made up at a time, as it keeps well, and sufficient developer should be poured into the tray to handle the prints nicely. When quite a number of prints are to be developed, at least two quarts of solution should be employed.

596. **Developing the Prints.**—Immerse the prints in the developing solution one at a time, face up; then, immediately turn them face down, and again face up. This insures an even covering of the print with the solution.

597. When the print is completely developed place it immediately in tray No. 2, which should be half filled with

water containing a few drops of acetic acid, which latter checks the development. The prints should be carefully rinsed in this acid solution for only a second or so, and then immersed in the hypo bath. To avoid stains it is essential that the print be completely immersed in this bath.

598. The formula for mixing the hypo bath is given in Volume IV, and plenty of solution should be prepared. The prints may remain in the hypo until all are developed, but if very large batches are to be fixed not more than one hundred should be fixed at one time, and even then, the prints, to prevent matting together and insuring thorough fixing, should be separated at least twice during the time of fixing. After fixing, place them in a tray containing running water. Handle the prints from one tray to another, using your former acid tray for your second tray in this instance. Two or three changes in this way, with water running in both trays all the while, will wash the prints sufficiently, after which they may be laid out to dry. Gather all the prints in one tray, and stand the tray on end, to drain, for, say, five minutes, thus eliminating all surplus water. The prints are then laid out on the drying racks, which are arranged in the operating-room, as previously described. They may be fanned dry in a few hours, when they are ready for gathering up, to be sent to the proper departments.

599. In Illustration No. 114, we present a floor plan of a convenient room for manipulating the *Record Outfit*.

CHAPTER XXVIII.

Photography for the Courts.

600. Photographic records, for use as evidence in court, are accepted in the majority of states, as well as in many foreign countries. It is vitally important that those persons connected with court proceedings be well informed upon the methods of making photographic records which are to be used as evidence. Not only must the photographer who intends to cater to this particular class of work, but also every lawyer, know the methods employed and the manner of securing such records.

601. **Photographic Distortion.**—It is a common statement, that “a photograph cannot lie;” but, as many photographers know, it is possible to misrepresent the appearance of a view by the use of an improper lens. For example, we may distort a subject considerably by using a lens of short focal-length. An object which usually appears perfectly normal if photographed with the average lens including a medium angle, will, when photographed with a wide-angle lens, show the objects nearest the camera to be larger in proportion to those in the distance. This is but one of the many ways in which the camera may not hold strictly to the truth, yet if it is known what kind of a lens was employed the observer will secure an accurate rendering of the scene and be able to interpret it in a truthful light.

602. In order that a lawyer or judge may intelligently treat with a case where photographs are to be introduced as evidence, it is essential that he be thoroughly informed with reference to the manner of securing photographs. He will then be able to tell in an instant whether the pho-

tograph was made with a wide-angle lens, or whether there has been a truthful rendering given of the scene or of the object photographed.

603. Photographs as Evidence for Damage Suits.—

When photographs are introduced in court as evidence it is essential that the photographer produce full and complete information regarding the methods he used in proceeding to secure the negatives. For this reason a notebook should always be carried by the photographer, and in this book an exact record made of each and every exposure. The first, and perhaps most important, item to be given consideration is the date and the time of day that the exposure was made. This should be given in exact hours and minutes, as a few minutes one way or the other might make the photographs of absolutely no value. Next in importance is the kind of lens, its focal-length, whether wide-angle, normal-angle or narrow-angle; also whether a rectilinear lens or an astigmat was used.

604. A Complete Record.—Another item of importance, which should receive attention in some particular cases, is to make a photograph of a scene, and then, leaving your camera on the tripod in the exact position from which the exposure was made, take another camera and photograph the whole scene, including the camera which made the print in question and the scene photographed by it. The two photographs shown in court will of themselves tell much of the story, and do it far more effectively than with the one print.

605. Truthfulness and Accuracy.—Where photographs of gaps or openings in the earth, holes in the ground, cracks in a wall, etc., are to be made in order to prove exactly the size of these openings, a measuring rule should be extended over the opening and this rule photographed in the scene. Where large openings are to be photographed, a long pole should be measured off in feet and placed over the opening. A two-foot rule, or even a yard-stick with registered scale of feet and inches, should

be placed on the one end of the pole, to further prove its accuracy, and the photograph made of the opening with the pole or rule in the view.

606. In any case where the height or size is to be shown, a measuring rule should be admitted into the view, as in this way you avoid disputes as to the accuracy of the picture. In all cases make your photograph prove its accuracy. With photographs of this kind, and a memorandum of all necessary data regarding the photograph in your note-book, you have very valuable evidence which is unquestionable.

607. **Minute Details Recorded.**—The size of stop, the exposure, the brand of plate, and the most minute details, should be recorded, for one cannot rely on memory for accuracy.

608. **Photographing Accidents.**—The photographing of accidents requires that the photographer be alert and on the scene in an instant, if he would secure, approximately, a perfect record. Although all accidents do not result in suits for damages, yet such proceedings may occur, and if they do your photographs with their data will be of inestimable value. There have been many cases where the photographer has photographed railroad wrecks and accidents of various natures, without taking into consideration that they would ever be used as court evidence, but later, when a suit has been brought for damages, his photographs have been of vital importance either to the prosecution or the defense, who willingly paid large sums of money to secure them.

609. There have been cases in which photographers have received from five hundred to two and three thousand dollars for a single print. It is a very common occurrence that photographs of this kind bring one hundred dollars each. All depends upon the nature of the case and the amount of money involved, as well as the decisive value of the photograph. Therefore, a careful memorandum should be made of all important data pertaining to the accident in which the photograph figures, and the picture numbered

to correspond with the data, being especially careful as to date and hour of the occurrence.

610. A recent railroad wreck on the Chicago, Milwaukee & St. Paul Railroad, in Wisconsin, was photographed by an amateur who had very little experience in photography. He secured not only views showing the wreck in general, but also made an interior view of a mail car, which showed the damage done in it. The train crews, as well as individual parties, purchased many of these photographs, the result of which netted the amateur about \$20.00.

611. A month later he received a letter from the attorney of the railroad, requesting a complete set of views of the wreck, and a check for \$10.00 was enclosed. (A mail clerk who claimed to have been injured in the wreck, had brought suit against the railroad company.) The views were forwarded, and much to the surprise of the amateur photographer, a couple months later he received a telegram to go immediately to Chicago and take a set of the views with him. Transportation was provided by the railroad company, and the amateur testified in the Superior Court that he made the photographs. He was questioned upon certain points, but the most important fact in his testimony was that he made the photographs at 5:30 A. M., which was twenty-three minutes after the wreck occurred.

612. Further than this, he testified that in the interior view of the car, the man who stood in the corner washing his hands was the man bringing suit against the railroad company for \$5,000 damages. At the time of the wreck, the mail clerk had been sleeping in his bunk above the mail pouches. His bunk was thrown to the floor, his head striking the corner of the frame which holds the pouches in position. He claimed that the injuries sustained necessitated his being removed on a stretcher immediately after the collision.

613. The photograph shows the man washing his hands, his back being toward the camera. His build and dress were recognized by other mail clerks. As the photo-

graph was made twenty-three minutes after the wreck, when, according to the testimony of the prosecution, this gentleman was under the care of local physicians at a neighboring hotel, it was impossible for him to be at the hotel. It happened that the local physicians who attended a number of other patients at the time had made no record of their names, nor did they remember whether or not they had attended this individual. The photograph, therefore, proved conclusively that the injured mail clerk had not been taken to the hotel, as he claimed, and it also proved that he was able to stand up and wash his hands at the basin in the corner of the car.

614. The testimony of the amateur photographer, together with his pictures, therefore won the case for the railroad company. For his services the amateur photographer received besides all his expenses and a check for \$100, a year's free transportation over their road.

615. **Detection of Crime.**—Perhaps the most important branch of photography, as applied to law and the courts, is its use in the detection of crime. It is possible for the lens to detect and pick out imperfections and minute detail that the eye would fail to observe. Then, too, it is possible to enlarge a picture to sufficient size to enable one to detect minute detail, and thus make a very careful study of whatever has been photographed. To illustrate this application of photography to the detection of crime, we might cite an instance which recently occurred:

616. **An Example.**—An aged lady, who was quite miserly and lived alone in a house, was frequently visited by a neighboring girl, about twenty years old. The elderly lady was very much attached to the girl. After a visit from her young friend one afternoon the lady died, and was found the following morning by a neighbor. The case was, of course, immediately reported to the authorities, who, in turn, made a very rigid examination, and without disturbing anything, other than to remove the body, sealed the house.

617. The case was a very mysterious one, as it was impossible to ascertain any direct motive for murder, nor was there any definite clue to be found upon which the detectives might work. The young lady was rigidly questioned, but her story was given in a very frank manner. She admitted having been with the lady during the day, but knew absolutely nothing of the crime until the following morning. Detectives, however, kept a close watch of the girl, and finally one, more skilled, perhaps, than the others, decided to photograph one of the foot-prints in the blood, which had been left on the floor at each step of the murderer. The foot-print was measured and the rule included in the photograph, at one side of the foot-print, to give exact measurement. The photograph revealed the fact that the murderer wore high-heeled slippers; that the left one had a hole, the shape of a cartridge, on the outer side of the sole; and that the slipper was an old one, as the side of the foot forced the cloth over the edge of the sole and left its imprint in the blood.

618. Further than this, it revealed that there was a small piece of felt in the center of the hole and that the stocking worn by the murderer was of very coarse material, as the threads were shown through the hole. The detective at once informed his confederates that the murderer was a lady, who wore high-heeled slippers, the left one having a hole in the center of the sole the shape of a cartridge; that there was a small piece of felt in or near the center of the hole, and that she wore a pair of coarse stockings.

619. Immediately a detective and one of the police officers went to the home of the young lady, as she was the person who had been most strongly suspected, though no direct evidence had been secured which could in any way lead to her arrest, and asked her what dress she wore on the day she visited the old lady. She immediately showed them all of the garments she had worn, revealing that her stockings were of coarse material, the weave corresponding exactly to that represented in the photograph through the hole in the sole of the slipper. Then they asked her to

see the shoes, which she unhesitatingly brought out, and although they were clean and showed no traces of blood, the left one answered the description perfectly of the photograph which the detective had secured of the foot-print. The girl was immediately arrested, and when her case was brought to trial and the photograph produced, together with the slipper, the evidence was considered sufficient and she was sentenced to life imprisonment.

CHAPTER XXIX.

Photographing Handwriting.

620. The study of handwriting in court frequently calls for a great deal of expert testimony on either side, and is often the cause of most puzzling and contradictory statements by the various experts. And it is easy to see why this should be so, when one considers that a person's handwriting is forever varying and changing, being as much subject to the moods of the person as the weather vane is to the gusts of the wind.

621. In every handwriting certain distinct features will continually appear—the dotting of the i, the crossing of the t, the peculiar formation of the r, etc.—but aside from these features, which sometimes only an expert in chirography can distinguish, the average handwriting will vary according to whether the writer is in a hurry or at leisure, whether in tempestuous mood or at ease with himself and the world. Is it any wonder, then, that even experts will disagree, each swearing to his own belief, or his own method of deciphering the writing in question?

622. The usual plan adopted in court, with signatures and all other handwriting, is to make enlargements, in which the various characteristics can be more clearly shown. Such enlargements should be made on transparency plates, for various reasons, more particularly because on a transparency plate an exact reproduction of the original can be procured, without elongation or stretching of the letters in any direction; whereas when paper is employed for the reproduction there is a certain amount of stretching, either in one direction or the other, often sufficient to entirely invalidate the value of the reproduction.

623. Then, again, where it is a question of comparing

specimens of the same handwriting with each other, the transparency reproductions can all be brought down to the same scale, and then being mounted one on top of the other will give greater opportunities for comparison than if laid side by side, as would be necessary in the case of paper prints. The eye is easily optically deceived, and in glancing from one sheet of paper to another can easily go astray; but this is impossible, of course, where two specimens of handwriting are superimposed on transparency plates, both specimens being visible to the eye at one and the same time.

624. **Making Negatives of Handwriting for Enlargements.**—Where entire letters are to be copied for enlargements, for use as evidence, they should be reduced in size, say, one-half. This will give you accurate lines to the edge. If negatives were made the exact size of a letter, unless great care was exercised and a corrected lens employed, you would be likely to produce a slight curve in the copy, which would show slightly in the negative, yet would become quite evident in the enlargement. By making the negative a reduced size all lines can be made true, and enlargements from such negatives will be accurate.

625. When making negatives of a signature, special care must be exercised, and the signature on the negative should not be any larger than the original, and as two signatures are generally photographed—the genuine signature with that which is considered a forgery—both should be photographed from the same distance.

626. For example: After making a negative of the genuine signature, leave the camera in exactly the same position and replace the genuine signature with the forgery, placing it in exactly the same place, and then make a negative of it. In this way you will be photographing at exactly the same distance from both, and for convenience a contact transparency may be made of each, first marking each negative so as to be able to distinguish one from the other. With transparencies the original size, they may be mounted together, so that they register over each

other. This method is only recommended where the forgery appears easily perceptible.

627. For critical work, enlargements must be made from the negative, and while prints are usually made on bromide paper, yet this method is not so satisfactory as the making of enlarged transparencies. For instruction for negative and transparency enlarging, see Volume V.

628. When it is suspected that the signature is traced over another, by adjusting the two enlarged transparencies, one over the other, this will be very easily detected. If they are not copied by tracing, or if a free hand attempt at writing the name is made, then each letter must be studied carefully, and by superimposing one transparency over the other the detection can be made.

CHAPTER XXX.

Photographs as Evidence.

I. ADMISSION NOT SUBVERSIVE OF RIGHT OF CROSS-EXAMINATION.

629. Photographs are not inadmissible as evidence on the ground that they deprive the adverse party of right of cross-examination.

II. WHEN ADMISSIBLE.

A. Ordinary Photographs.

630. (1) *As primary evidence.*—While it has been held that photographs never rank higher than as secondary evidence, they are undoubtedly primary evidence (and as such admissible) upon issues directly involving their *character* or *quality*. With reference to character is the displaying or selling of obscene pictures, while of quality, in an action brought by a photographer for the value of his services.

631. *Best Evidence.*—It may even be said that photographs constitute the best evidence possible of the physical appearance of human beings, animals, or conditions that have ceased to exist. Photographs of deceased persons are introduced in court, to show wounds inflicted by murderers; healthy appearance of deceased; physical characteristics of deceased; probabilities of future physical development; characteristics, vigor, disposition and temperament of deceased. Photographs of animals are introduced to show

their appearance when alive, while the use of photographs of different conditions which have ceased to exist may be classed under the headings: Appearance of railroad wrecks caused by collisions; appearance and conditions of streets after storms; as well as the previous physical appearance of a person.

632. (2) *As secondary evidence.*—It may be laid down, as a general rule, that, subject to the rules governing the admissibility and introduction of secondary evidence, photographs are competent, though in some cases slight, evidence of the identity, appearance and physical characteristics of the object which they delineate, whether such objects be animate or inanimate. Photographs, however, are inadmissible when better evidence can be, or has been, produced. One very important point which should be remembered is, that photographs taken two years before death are not too remote, in cases where it is necessary to prove the identity of persons, to be admitted as evidence. A photograph taken from another photograph may be used as evidence.

633. (3) *As explanatory or illustrative evidence.*

(a) In general, the most common use of photographs as evidence is to enable witnesses to make their testimony clear, and to enable judges to understand it better. For these purposes photographs are used in making comparisons of handwriting and in illustrating descriptions of localities. Photography assists materially in making clear one's description of scenes of assault, murder, or accident. They are also very important evidence to introduce in action for injury. *Photographs which are not instructive should not be used.*

634. (b) *Enlarged photographs—stereoscopic views—transparencies from negatives.*—When additional instruction is given by the court it is permissible to use either photographs which are on a larger scale than the originals, or stereoscopes and stereoscopic views or transparencies from negatives. The magnifying of handwriting makes it more easy for the jury to examine the evidence, while if the

photograph itself has not been enlarged it is permissible for the jury to use a magnifying glass when examining photographs; but where possible to do so, it is far better to enlarge the photograph that is to be introduced as evidence.

B. Necessity of Proving Accuracy.

635. The right to introduce photographs in evidence is always dependent upon the making of preliminary proof of their accuracy. Photographs must be shown to be accurate representations. This proof may be made by any person of good eyesight, who is familiar with the persons, places or things represented by the photographs.

III. WHEN ADMISSIBLE.

636. Photographs cannot be made the media of getting improper evidence before, or for playing upon the passions of, the jury. Photographs of persons in the nude are improper and not admissible. The reproduction of tableau planned to intensify dramatic effect of witness' testimony is also inadmissible, but a photograph of the scene of a tragedy, made and offered in good faith, is not rendered inadmissible by the fact that it contains figures to indicate the respective positions of the principals. Photographs appealing to passions of jury, and neither necessary nor instructive, are inadmissible, but photographs otherwise proper as evidence are not inadmissible because calculated to awaken sympathy.

IV. DISCRETION AS TO ADMISSION OR EXCLUSION.

637. It has been held that it is within the discretion of the trial judge to admit or exclude photographs offered in evidence. He is the one to decide whether a photograph is instructive. This discretion, however, usually extends only to the matter of the verification.

CHAPTER XXXI.

Use of Photography in the Schools.

638. **Introduction.**—It is always essential to have records of plant growth, as well as of the arrangement of apparatus used for the various experimental sciences. In the past it has been customary for the student to make drawings of the various stages of plant growth, and to illustrate, by means of the pencil, the various experiments in chemistry and mechanics. The object of making these illustrations is not to train the student in the art of drawing so much as it is to secure a record which can be placed in the note-book, to show the experiment more clearly than is possible to describe it in words.

639. It is a generally conceded fact that the average student is a poor draftsman and fails, in many instances, to give a proper rendering of his subject; thus the drawing does not give an exact record.

640. Colleges and universities, as well as many of the public schools, are resorting to the use of photography, making a practical application of it. In no place will it be found more valuable than in making botanical records and showing the arrangement of experimental apparatus used in the various sciences, such as chemistry, electricity, etc.

641. **Inexpensive Process.**—One negative of an experiment is all that is required, as an unlimited number of copies may be secured from it, thus giving each student a perfect record of the experiment to place in his note-book. The expense is practically no greater than the procuring of drawing materials, and the loss of the time required to make a drawing, by each individual member of the class, is avoided.

642. **Photographing Seeds.**—Usually one of the first records made by students in botanical classes is that of the development of a plant from the seed. In the first of the series of illustrations accompanying this instruction—Illustration No. 115—is shown the manner of procedure. In order to photograph seeds to the best advantage, they should be placed in a diagonal position to the camera (See Fig. 1). The usual method of starting a seed germ is to saturate a blotter with water and lay it on a board. On top of this place a layer of cotton, also saturated with water, and then lay the seeds in place. *For experiment we have selected three lima beans, three black beans, three golden-eyed wax beans, three kernels of corn and six peas.* Another strip of cotton is saturated with water and carefully laid over the seeds; the first photograph being made, however, previous to drawing the upper layer of cotton over the seeds.

643. **Daily Records.**—The photographic records should be made daily and at approximately the same hour of the day. This is comparatively easy, as class periods are usually at the same time.

644. **Location of Camera.**—The distance between the lens and the subject in every record made of the same series should be the same. For ascertaining its distance, a yard or meter stick will be a convenient accessory. The object of always having the camera at the same distance from the subject is to show in a most accurate manner, the actual development which takes place from day to day.

645. **Rapidity of Growth.**—The temperature of the room in which the specimens are kept will have much to do with the progress made in the development of the seed germ. The amount of daily growth will be the factor governing the intervals between making of photographic records. Instead of making the exposures every day, it may be thought more advisable to do so every other day. A photographic record made every day will, however, show a certain amount of development.

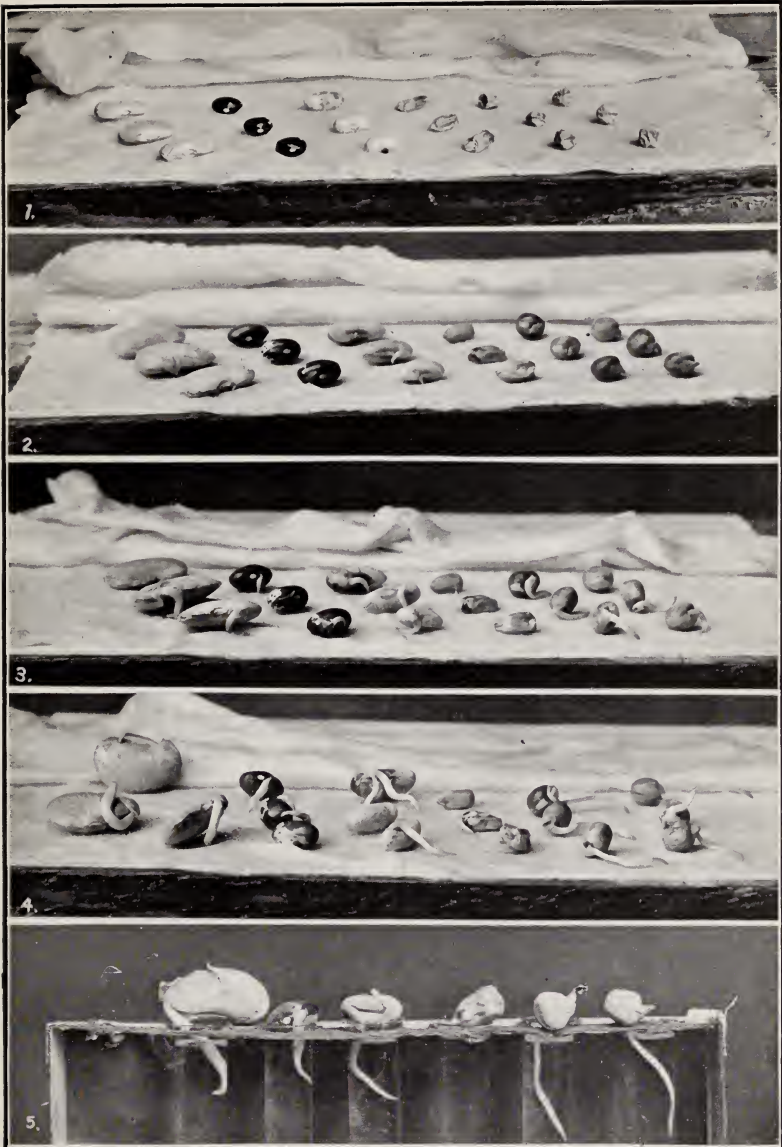


Illustration No. 115
Botanical Studies—Development of Seed Germ
See Paragraph 642

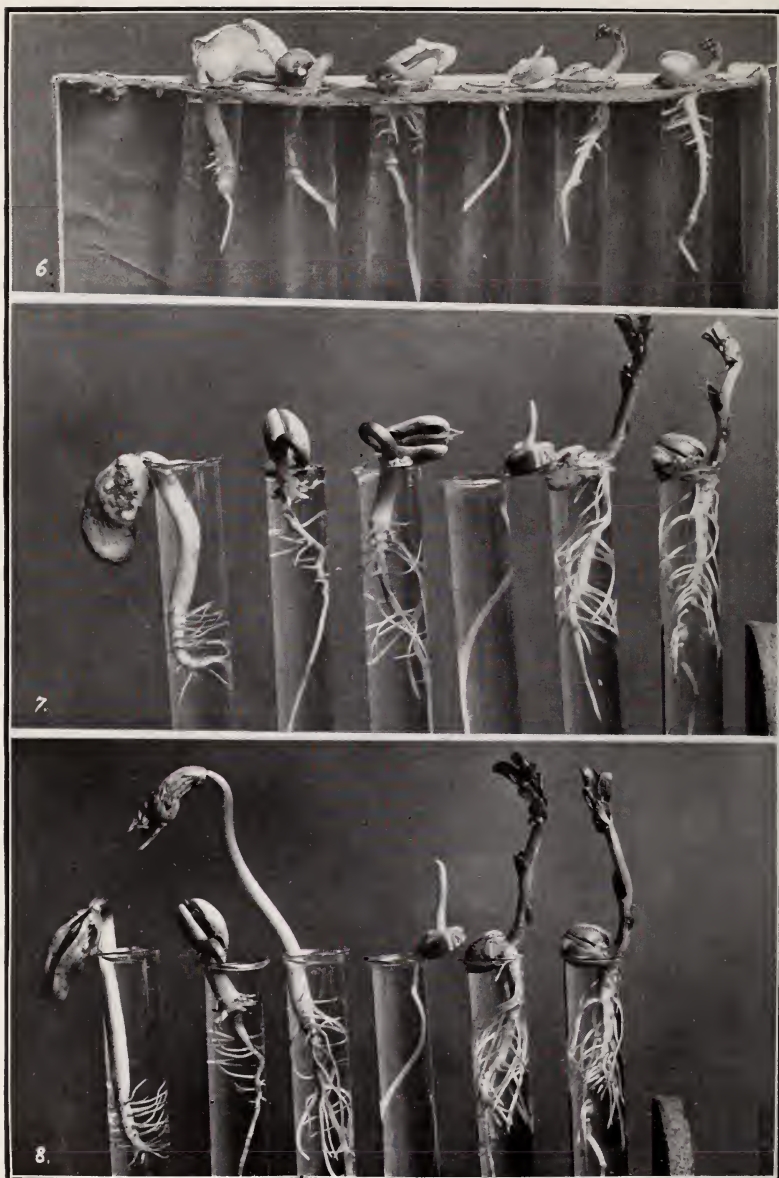


Illustration No. 116
 Botanical Studies—Development of Seed Germ
 See Paragraph 648



Illustration No. 117
Botanical Studies—Development of Seed Germ
See Paragraph 648



Illustration No. 118
 Botanical Studies—Development of Twig
 See Paragraph 650



Illustration No. 119
Botanical Studies—Development of Twig
See Paragraph 650

646. Care should always be exercised that the seeds are in the same relative positions when making each record. After the sprout has become $\frac{1}{4}$ inch long it will, however, alter the position of the seed. Fig. No. 2 of Illustration No. 115, shows the seed after it has swollen and the germ started to grow; Fig. 3 is the next stage, then Fig. 4. In the latter view the seeds have been intentionally placed in different positions so as to show various views of the subjects.

647. At the end of the first week test tubes should be placed in a rack, or a convenient support, and filled with water. The root sprout of the seed is then placed in the water. The seed being of sufficient size, it will find a support on the edge of the test tube. If a regular test tube rack is not at hand, small holes can be cut in the side of a pasteboard box and the test tubes inserted in these. (See Fig. 5, Illustration No. 115.)

648. The three views shown in Illustration No. 116 (Figs. 6, 7 and 8), further demonstrate the rapid growth, also the sudden changes which take place during the progress of the plant's development. Following these we have the views shown in Figs. 9, 10 and 11 of Illustration No. 117. The series of eleven views cover a period of a plant's ordinary growth, under natural conditions, during a period of two weeks.

649. **Value of Photographs.**—This photographic illustration clearly shows the actual value of photography in illustrating the progress made during the growth of the seed to a fully developed plant.

650. **Development of the Twig.**—Another interesting subject, and one which is usually given consideration in public schools, is the making of records to show the development of twigs. In the early spring, just as the buds begin to burst, a collection of different twigs should be procured and these placed in test tubes of water. The larger the variety of these subjects the greater will be the value of such a record, for the series of photographs will show the rapidity of the development of one subject over an-

other. In Illustration No. 118, the twigs used were (reading from left to right), maple, plum, apple, sumach, chestnut, poplar, blackberry and walnut. The photographs were made every two days for these four illustrations. Fig. 5, Illustration No. 119, shows the subjects in their respective test tubes in the rack. Fig. 6 of this same illustration shows these twigs at the end of three weeks growth. The intermediate stages between Fig. 4 and Fig. 6 have been omitted, but the student should make negatives at regular intervals (every two days) up until this time, in order that the record may be complete in every respect.

651. **Other Subject Material.**—These two series of subjects are given to illustrate the application of photography to botanical work, but photography can be applied wherever a drawing is required. For instance, a valuable record may be obtained of the construction of different leaves, the veins, etc., all being accurately reproduced.

652. **Photographing Leaves.**—The most satisfactory method of photographing leaves to show the veining is to place the stem of the leaf in red ink and allow it remain there until the veins are completely filled, which will usually take about 24 hours; then lay the leaf carefully between two sheets of clear, clean glass and bind them together with lantern-slide binding or passe-partout tape. This subject may then be placed in the regular copying frame, as described in Vol. V, and an exposure made in accordance to the instructions given for copying. The result of proceeding in this manner will be a negative in which the veins of the leaves will be transparent, while in the final print they will be practically black, the fleshy part of the leaf being of a sufficiently lighter shade to contrast strongly with the veins. By placing the leaf between two sheets of glass the serrated edges and general outlines of the leaf will be accurately reproduced.

653. As previously stated, each and every experiment, not only in botany but in chemistry and other similar sciences, should be photographed, the views chosen being such as will show forth, to the best advantage, the im-

portant points which the student considers in his regular lesson work.

654. **System to Employ.**—Every school should be equipped with a photographic dark-room. Many educational institutions have installed a complete system for instruction in photography, and where this is the case photography should, by all means, be employed in the making of records of various experiments. In the event that a school is not provided with photographic conveniences, an individual member of a class, who is interested in photography, may take it upon himself to secure the photographic records. The expense (which will be very slight) may be divided among the individual students, if the school does not appropriate the necessary funds. These photographic records are of immense importance to the individual student, and each member should unhesitatingly avail himself of the opportunity of securing photographs of the various experiments rather than attempt the making of drawings.

655. As previously stated, the average student is not very apt in the art of drawing, and the time consumed in making illustrations by means of the pencil could be far better spent in studying the natural object and the perfecting of apparatus, and in properly performing and arranging the experiments, so that each item would show to best advantage in the photograph. The details and the method to employ will depend very much upon the conditions existing in each school; but the essential features with reference to the photographic apparatus will be the same, no matter whether an individual student takes charge of the work or whether the school itself has its own equipment.

656. **The Camera.**—It is not necessary that the outfit be at all expensive, yet the better the apparatus employed the more certain and the more satisfactory are the results bound to be. Much will depend, however, upon the operator, for the knowledge of the methods to employ is of as great a value as the apparatus itself. A camera that will

make a picture 4 x 5 inches in size will answer every purpose, and the expense of using a plate of this size will be very slight. On the other hand, a 5 x 7 picture will give a larger image, and in many cases prove more valuable than the smaller size.

657. In order that different classes of subjects may be adequately reproduced it would be advisable to have a 5 x 7 instrument. Kits may then be inserted in the plate-holders and 4 x 5 plates used where the 5 x 7 size is not required. The ground-glass should of course be ruled accordingly; *i.e.*, lines showing the boundary of the 4 x 5 plate should be drawn so as to come exactly in the same position as the 4 x 5 plate in the holder. A swing-back or swing-bed will be found a valuable attachment to the camera, for it will be often necessary to tilt the camera, and the perpendicular lines in the subject would be distorted if the plate were not kept parallel to them.

658. **Lens.**—It is not necessary to have an expensive lens, the main requirement being correction for chromatic aberration and spherical aberration; the lens should also give a perfectly rectilinear reproduction of all lines. The speed of the lens is not an essential factor, for the subjects are all still life, and an exposure of from twenty seconds to a minute or so will not be at all objectionable. An extra rapid rectilinear lens of good focal-length will answer every purpose. In fact, it will be far better to use a lens of this kind if those who are to make the pictures are not thoroughly familiar with lenses of the anastigmat type. The ordinary long-bellows hand-camera fitted with a rectilinear lens will answer every purpose.

659. **Stop to Use.**—Depth of focus is a very essential factor, and in order to reproduce all portions of the subject perfectly sharp, a mediumly small stop will have to be used. F.16 or U. S. 16 will, in the majority of cases, be the proper stop to employ when the subjects are all in one plane and the distance from the nearest point of the object to the farthest is not over 2 inches, with the lens of the

camera 2 feet from the nearest portions. The farther the lens is from the object the greater will be its depth of focus, of course, but when employing a rectilinear lens the stopping of it to 16 will insure equal sharpness throughout.

660. **Plates.**—An ordinary *slow* or *medium* speed plate may be employed when photographing the average subjects. Flowers, however, and all material in which it is important to bring out all of the color values, should be photographed on color sensitive plates—preferably panchromatic or trichromatic plates. A lemon-yellow ray filter, increasing the exposure three to five times, should be used in conjunction with these plates. (See Volume II for full description and methods of handling color sensitive plates and filters.)

661. **Background.**—The background is a very important factor. A white one should be employed when the majority of the subjects or objects photographed are dark, while if they are light a black ground should be used. These two extremes will be all that is required, and their method of use and application is described in Volume III, Chapter XX, *Floral Photography*.

662. **Support for Camera.**—A tripod will answer every purpose for supporting the camera, yet a regular copying board, similar to the one described in Volume V, will be found a more satisfactory piece of apparatus for many still life subjects, and especially in the study of botany, but for all-around work the tripod will answer every purpose.

CHAPTER XXXII.

Photo-Micrography.

663. **Introduction.**—Photo-micrography is the art, or process, of enlarging minute objects by means of the microscope, and reproducing the enlarged image by photography.—*Century Dictionary*.

664. The production of photographic images of microscopic objects is one of the most interesting and instructive branches of photography, as well as one of the most important, from a scientific standpoint. Any one familiar with the use of an ordinary camera and a microscope will, by following the instructions given in the subsequent pages, have at hand an inexhaustible field of interesting study.

665. The amateur photographer can entertain all members of the family with the many wonderful features possessed by the most common insect, plant or flower, which are invisible to the naked eye, but when photographed through the microscope will show something of the marvelous and beautiful workings of nature. A thousand and one objects, insignificant in themselves, when viewed through the microscope become veritable mines of interest to the mind of the ordinary man, woman or child, and when enlarged by the aid of photography, the reproductions can be studied, children instructed, and their minds broadened thereby and made more receptive. It should be the aim of every amateur worker to become familiar with this branch of photography.

666. In schools and colleges photo-micrography is of the utmost importance, and its practice will result in the saving of money and time; clearer, and more complete instruction can be imparted to the class. Any number of prints can be made from the photographs taken through

the microscope, and used by the students with most satisfactory results, as they will be able to follow instructions more closely and intelligently by having the photograph of the subject before them, and at the same time, by this method, particularly fine specimens are preserved for future reference and instruction. By means of the photo-micrographic print a greater number of students can be handled, than is possible where each individual member of the class is obliged to use the microscope, in turn, to understand fully the instruction being imparted. This is the method of instruction in the leading medical schools of Europe and America.

667. The strain on the eyes, complained of by so many when looking through the microscope, is avoided by photo-micrography, and all can pursue their studies with greater interest and enthusiasm. These photographs can also be reproduced on lantern-slides, for lecture purposes, full instructions for which will be found in Volume V. The naturalist and the botanist are provided with an invaluable assistant in photo-micrography, in that rare specimens are preserved in all their beauty for reproduction in book or magazine. By following instructions covering transmitted light and opaque illumination, photographs reproducing microscopic objects on transparent slides can be made, or depressions, minute cavities and formations on the uneven surfaces of minerals clearly shown as they appear through the microscope.

668. To the physician photo-micrography is a necessity, and the more general its practice among the medical profession the greater will be the diffusion of knowledge, and the more accurate and valuable this knowledge. It also prevents all possibility of intentional or unintentional misrepresentation. Practical instruction is given for starting you right upon this special branch of study.

669. In Fig. 1, Illustration No. 120, is shown a microscope of sufficient power for the physician's research, bacteriologists agreeing that the magnifying to $+1000$ being all that is required. The camera attachment to the micro-

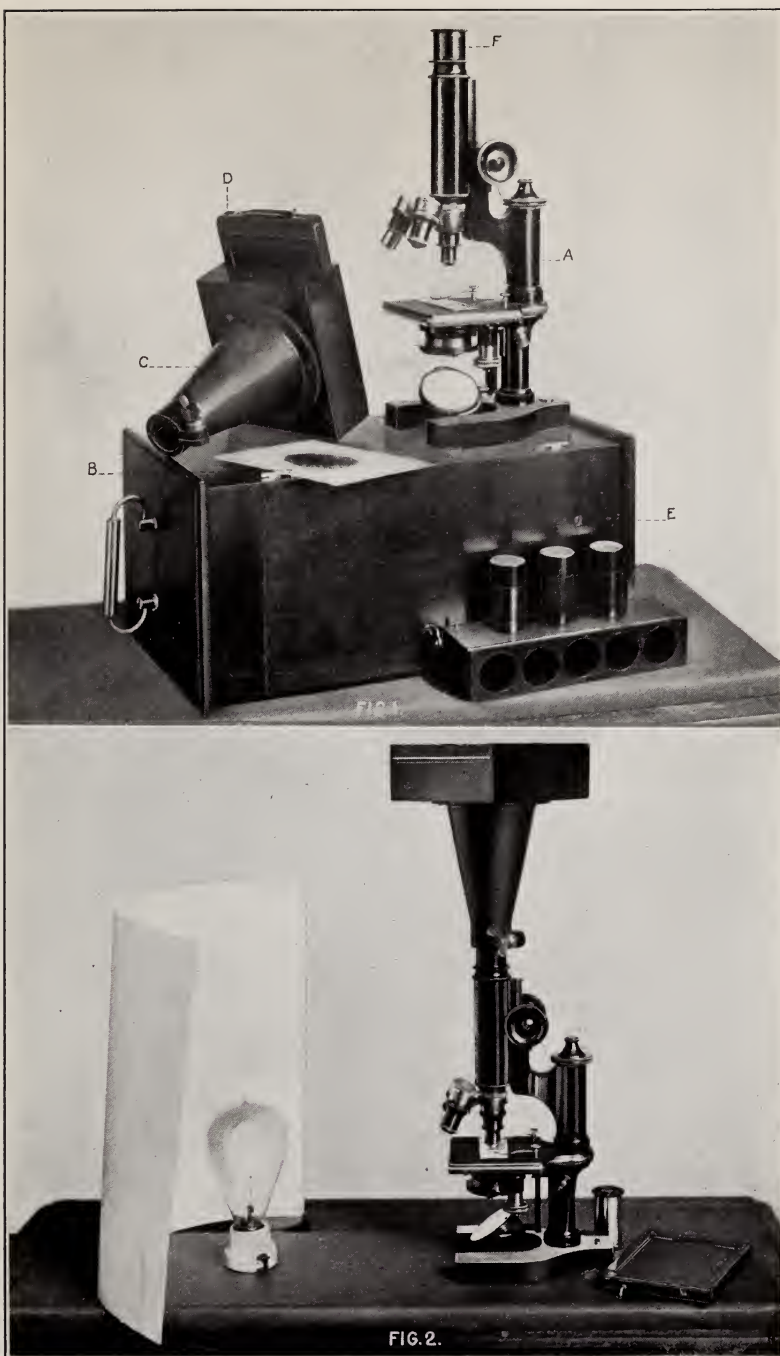
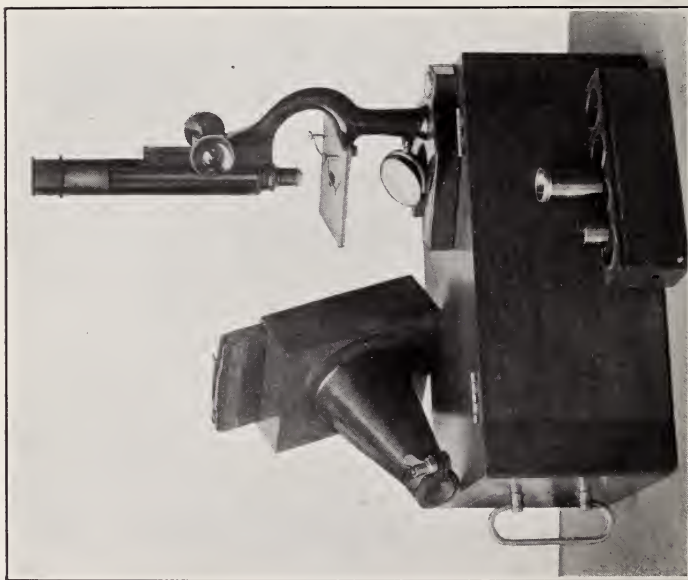


FIG. 2.

Illustration No. 120
 Practical Outfit for Physician or Naturalist
 See Paragraph 669



A Illustration No. 121
Simple Form of Microscope
See Paragraph 672

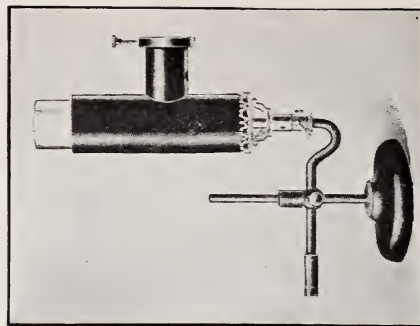


Illustration No. 125
Welsbach Gas Lamp
See Paragraph 686

scope is of simple construction and will answer for all practical purposes. The intelligent use of photo-micrography is of the utmost value to every physician and surgeon, whether specialist or general practitioner, for by its means he not only is able to prove to his satisfaction his diagnosis or findings, but has material immediately at hand for future reference, which cannot fail to help him in his practice.

670. Photo-micrography gives to all a new field of study, and one that is filled with the most unexpected and beautiful creations of Nature's workshop.

671. **Expensive Apparatus not Essential.**—For the student or household an expensive outfit is entirely unnecessary. Any ordinary microscope with a good solid base, and containing a fairly fine focusing rack and pinion, will answer almost every purpose. With such an instrument a two-thirds or one-sixth objective may be employed. However, the low-power two-thirds objective will prove the most serviceable, and a one-sixth is really unnecessary.

672. For botanical studies the two-thirds objective is the only one for the student to use. This stand fitted with the Schriever Microscopic camera makes the outfit complete. A reproduction of this outfit is shown in Illustration No. 121 and the camera can be procured from the American School of Art and Photography, Scranton, Pa.

673. **Practical Outfit for the Physician or Naturalist.**—While for this outfit a very elaborate camera may be employed, with long extension bellows and tilting stand for working upright or horizontally, yet for all practical purposes the camera attachment shown in Illustrations Nos. 120 and 121 will answer, and by its use the very best of results can be obtained. For the more advanced or for physicians' use a better microscope, however, is required, but the same camera may be employed. For this purpose we recommend, and include in this outfit, the stand, BB8, manufactured by the Bausch & Lomb Optical Company, Rochester, N. Y. This is a standard instrument for every kind of work. It is a very necessary requirement for the

use of low and high-power lenses, and is, therefore, universally used by physicians. In this outfit is included a two-thirds, a one-sixth and also a one-twelfth oil-immersion objective.

674. The stand is fitted with both coarse and fine focusing adjustments, an Abbe condenser with Iris diaphragms being also supplied. The instrument is supplied with plain and concave mirror, extra large, adjustable vertically on a swinging arm for focusing the mirror and to secure oblique illumination. The pillar is made with a joint for inclination, and with a stop for holding the body exactly horizontal when inclined. A reproduction of this complete outfit is shown in Illustration No. 120, Fig. 1.

675. **Description of Outfit, Illustration No. 120.**—a, is the microscope; b, is the ground-glass screen; c, camera attachment; d, the plate-holder; e, carrying case for the microscope; f, eye-piece. These are the principal attachments to which we will refer in the instruction to follow.

676. **Supports for Instruments.**—It is important that the instruments be placed on a solid, level support, which is perfectly rigid, to avoid any movement whatever, for the slightest movement will interfere with the obtaining of perfectly sharp results. A good, solid, heavy table will answer every purpose.

677. **The Dark-Room.**—One of the indispensable accessories in connection with photo-micrography is the dark-room. While this room need not be very large, it must be absolutely light-tight, and for comfort should be well ventilated. To make it more complete, it should have running water. An ordinary closet can be arranged to advantage. Where the work is done at night any ordinary room which can be made absolutely dark will answer. For the physician his regular office or consulting-room fills every requirement. In the consulting-room, or some side room, a very neat closet can be fitted up by partitioning off one corner of the room. This dark-room need not be larger than 3 x 3 feet.

678. **Dark-Room Equipment.**—For convenient work-

ing the dark-room should contain the following paraphernalia, or its equivalent: 4 rubber trays, 4 x 5; 1 rubber fixing box, 4 x 5; 1 zinc washing box, 4 x 5; 1 small negative rack; 1 dark-room lamp (developing lantern); and regular developing chemicals, depending upon the developing formula employed. The dark-room lamp should be of good size and well ventilated. The Ingento ruby lamp is well equipped with all requirements. It is large, having a door on each side, one side containing a ruby light which supplies the illumination by which you may develop the plates. The other side has a ground-glass for exposing the developing papers and examining the plates after they are developed and fixed. Either gas, or kerosene oil, or electric light can be used as the illuminant in this lamp. The front section has three removable 7 x 9-inch glasses, ruby, orange and brown, thus securing any quality of light, and the lamp is of ample proportions to avoid over-heating. If kerosene oil is used, ventilation is provided for to prevent an offensive smell. When using the lantern for developing, the flame should be kept quite low. This will not only prevent over-heating, but provides against fogging the plates during development. For complete information for dark-room see Volume II.

679. **Illuminants.**—Photo-micrographs may be made by either daylight or any artificial light, but more uniform results will be obtained by means of artificial light, as it is not as strong as daylight—it permits of more latitude in exposure and is more even. However, one should be guided by one's own conveniences.

680. **Daylight Illuminant.**—When using the microscope and camera for daylight illumination, do not place the instrument in direct sunlight. Subdued light is best, as it allows for more latitude in the exposure. Neither should you place the instrument too near the window, but close enough to obtain illumination and overcome the reflection of the division sash of the window into the mirror. Usually, working about two feet from the window will give you good illumination.

681. **Diffusing the Light.**—A very good way to modify the light, if too strong, is to provide a piece of heavy cardboard, about 14 x 17 inches in size. Near one end of the cardboard cut a square opening about 10 x 12 inches. Cover this opening with fine white tissue-paper, pasting around the edges. About three or four inches from the bottom of this card, bend it at right angles to form a base for its support. The sides are braced by means of cardboard cut wedge-shape and glued into the corners. See Fig. 1, Illustration No. 122, which illustrates completely the arrangement for daylight exposure.

682. **Artificial Light.**—In Fig. 2, of Illustration No. 120, is shown the use of electric light for exposing. For this purpose a 32-candle power incandescent bulb is used. In this illustration you will observe the large, white card back of the electric bulb which serves as a reflector. By means of the reflector the light is made more powerful, thus shortening the exposure. In Illustration No. 123, Fig. 3, is shown an arrangement for illuminating by gasoline vapor lamp. This class of light is used practically the same as the electric light. Fig. 4 shows the arrangement for illuminating with gaslight.

683. These different illustrations show the various forms of artificial light, and have all been tried and found to give satisfactory results. If none of these sources of illumination are available, a good kerosene lamp can be used with success, but considerably longer exposure will be required. The selection of the illuminant is entirely immaterial. You must be guided by your surroundings, and you may make use of any light at hand. The use of gaslight is, perhaps, the most convenient and easily manipulated, and it is almost universally available, as nearly every city and town has its gas supply system.

684. **Note.**—Where manufactured gas is used it will be necessary to use a globe that is perforated at the base with holes about $\frac{1}{4}$ inch in size. This supplies vents for the air and a steady illumination is secured. (See A, Fig. 3, Illustration No. 124.)

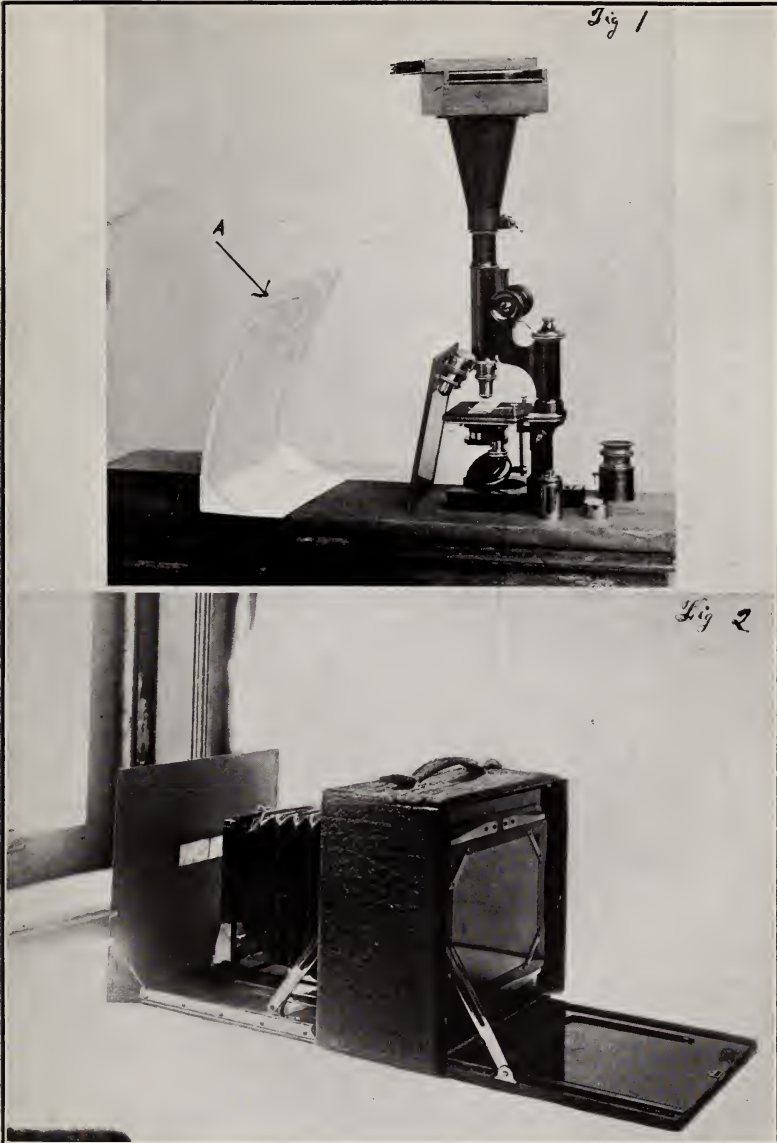


Illustration No. 122
Fig. 1, Daylight Illumination
Fig. 2, Enlarging Microscopic Slides
See Paragraph 681



Illustration No. 123
Artificial Illumination
See Paragraph 682

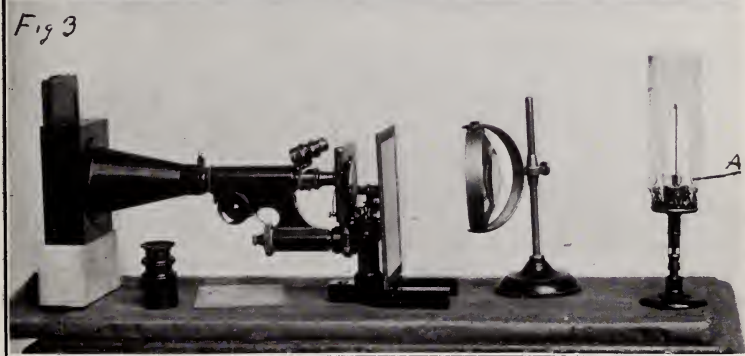
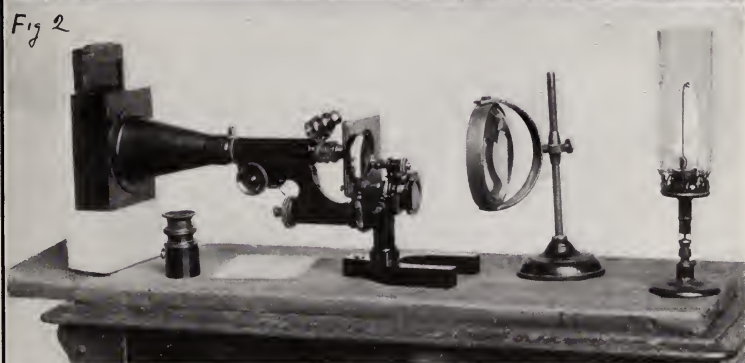
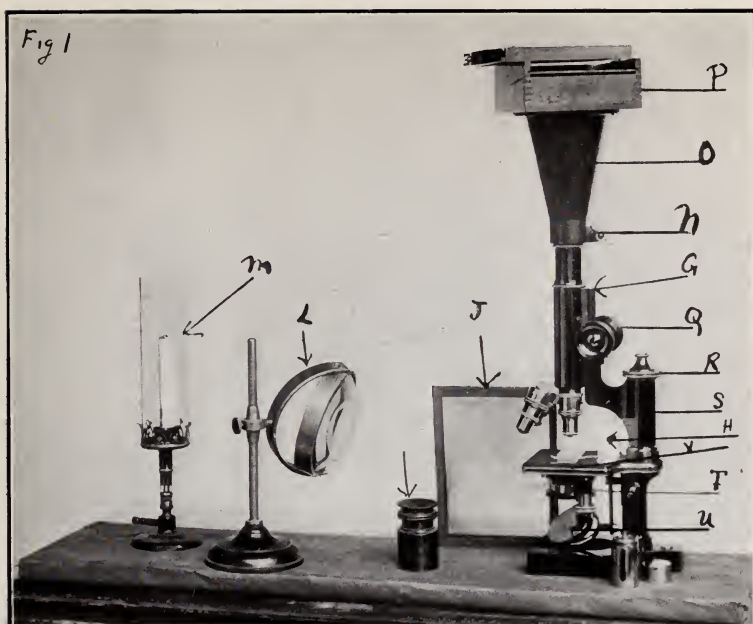


Illustration No. 124
 ° Physician's and Naturalist's Outfit
 See Paragraph 684



Fig 1



Fig 2



Fig 3

Illustration No. 126
Focusing and Adjusting Object for Microscopic Reproduction
See Paragraph 687

685. In Figs. 2 and 3 of Illustration No. 124 is shown a horizontal arrangement of the camera and microscope for gaslight illumination. The camera is supported by a solid wooden block, which makes the camera quite rigid. When used horizontally the Abbe condenser is usually dispensed with and the bull's-eye condenser is substituted. The horizontal arrangement will be found the easiest for illuminating the slide, but aside from this the upright position will give you a more rigid support for the camera and the focusing will be much simpler and easier to adjust. In Fig. 3 of Illustration No. 124 we have the horizontal use of the microscope with the yellow screen or filter.

686. **Welsbach Gas Lamp with Bull's-Eye Lens.**—In place of the bull's-eye condenser, and where gaslight is used as the illuminant, the Welsbach gas lamp with metal chimney and iris diaphragm, and bull's-eye lens, as shown in Illustration No. 125, page 344, may be used. This illustration represents an ordinary Welsbach lamp fitted with a metal hood which cuts off all unused light, and the lens barrel, being supplied with an iris diaphragm, concentrates all the light on the object. By the adjusting of the iris diaphragm you can illuminate the structure of the mantle of the lamp. Where no diaphragm is used a ground-glass may be placed between the burner and the microscope in the same manner as the color-screen in Fig. 3, of Illustration No. 124. Without the ground-glass or diaphragm the structure of the mantle would appear in the picture.

687. **Reflected and Transmitted Light.**—After the question of illuminant has been settled, we next have the nature of the object to be photographed to contend with. While most of the subjects selected to be photographed are sufficiently transparent to be illuminated by light transmitted from the mirror, yet some subjects, such as minerals, shells and plants, are so dense in their structure that direct light such as would be used with the instrument arranged horizontally, or the light reflected from the mirror below the stage will not pass through them and, therefore, will need to be photographed from their reflected surface—in

other words, with the light falling *upon* the object instead of transmitted *through* the object. The latter mentioned class of subjects requires a low-power magnification, and for the best of results the bull's-eye condenser should be employed. This condenser is designated by the letter L of Fig. 1, Illustration No. 124, and is shown in its proper position for opaque illumination in Fig. 1 of Illustration No. 126. You will also observe the gaslight is arranged at an elevation above the stage. This is necessary to bring the ray of light through the bull's-eye condenser onto the surface of the object on the slide.

688. Additional important parts to this outfit are designated in Fig. 1, Illustration No. 124, as follows:

- G—Coarse adjustment rack
- H—Cardboard or tin reflector
- I—Cedar oil bottle in nickel case
- J—Yellow filter screen
- K—Hand-focusing glass
- L—Bull's-eye condenser
- M—Welsbach light
- N—Camera cone thumb-screw
- O—Camera cone
- P—Camera box
- Q—Coarse adjustment
- R—Fine adjustment
- S—Objectives
- T—Abbe condenser
- U—Reflecting mirror
- V—The stage

689. The bull's-eye condenser, when employed on opaque subjects, is used in a manner to concentrate a beam of light upon the surface of the object; while when used for slides of transparent subjects the bull's-eye condenser is used to concentrate light upon the mirror or below the stage, and the mirror in turn, reflecting this light through the object or slide. H is a small piece of tin or white cardboard, bent in a semi-circular shape placed behind the slide to further assist in reflecting the light upon the object.

CHAPTER XXXIII.

Apparatus for Photo-Micrography.

690. **Use of Mirror to Illuminate the Slide by Transmitted Light.**—Proper manipulation of the mirror for reflecting light is very important and should always be carefully done, as one may fail to obtain the best results and may be led to reach wrong conclusions. Where strong daylight is used for focusing, the improper use of the mirror may become injurious to the eyes. The mirror of the microscope is double—one side being *plain* and the other *concave*. The mirror is provided with a universal joint to reflect the light from any source, either from the front or side of the microscope. The *plain* mirror is used with *low* power objectives; while the *concave* mirror *converges* the rays on the object and thereby gives intensified illumination; the latter is used with *medium* and *high* power objectives. When daylight is employed the concave mirror, converging the light as it does on the object, has a focal point, and this is of such length that with parallel rays it will concentrate on the object.

691. **Use of the Abbe Condenser.**—With artificial light the focus will be longer, as the rays are more diverging, and when no provision is made in the instrument to adjust the mirror to meet these two conditions, it becomes difficult, and sometimes impossible, to obtain the best results in critical work. For this and other advantages, an additional illuminating apparatus, termed an Abbe condenser, is now universally employed with both medium and high power objectives. The purpose of the Abbe condenser is, to give an amplified field of illumination when the illuminant is otherwise insufficient to illuminate the object with a cone of light having an angular aperture equal to that

of the objective, as well as to provide the means for controlling the amount and character of the illumination to suit the various conditions of work.

692. This condenser is attached beneath the stage of the microscope and is mounted in a most complete form. (See T, Fig. 1 of Illustration No. 124.) Where the Abbe condenser is used, careful attention must be given to illuminating the object. A good rule to follow is to use concentrated illumination, diaphragming down to as small an opening as will permit of showing the structure and other characteristics of the object.

693. It is also advisable where the Abbe condenser is employed, to use the plain mirror for reflecting the light, and, whether artificial or daylight is employed, the blue screen which is fitted in the Abbe condenser should be used.

694. **Plates to Use.**—While almost any reliable brand of plates may be employed, yet a very rapid plate is quite difficult to handle, and where ordinary plates are employed the slower emulsion is preferred. For the best results, and in cases where color values are to be preferred, it is absolutely essential that color corrected plates be used, such as orthochromatic, isochromatic or panchromatic. For ordinary subjects where color values are not important the double-coated ortho or non-halation plates will answer.

695. When color sensitive or double-coated plates are not available, slow plates may be used quite satisfactorily and longer exposures given. When orthochromatic plates are employed, care should be exercised in loading the holders, as the plates are very sensitive even to the ruby light, and the holder should be loaded either in total darkness or at a distance from the ruby light; otherwise fogged plates will result.

696. **Note.**—For very critical work, where the relative color values are of utmost importance, the new Autochrome plate may be employed, which will give a transparency of the object in actual colors. For instruction in the manipulation of this process, see Chapter LIX, Color Photography.

697. **The Objectives and Focusing Attachment.**—The

most important parts of the microscope are the objectives and focusing attachments. The objectives, or lenses as they are sometimes called, are the vital parts of the microscope. According to their magnifying power they are termed low power, medium power and high power. All high-grade microscopes, such as the BB8 shown in Illustration 120, are supplied with oil-immersion lenses, also three objectives—low power, marked two-thirds; medium power, marked one-sixth; high power, marked one-twelfth.

698. Students, or beginners, as a rule, are apt to use too much magnification, and often attempt to view a large surface with an objective which will show but a small part of it. It must not be forgotten that the apparent field of view is *decreased* as the *high* powers are used, and that a *low* power objective will give a better impression of a large coarse object and its relative parts, because it includes a *larger* area or surface in the view.

699. In all known objects it is safe to adopt the following rule: Never use a higher power than is necessary to properly study the object. In fact, for the first experiments it is best to begin with a low power (two-thirds) objective, remembering that the *higher* the power of the objective, the *less* space there is between the objective and the slide, which necessitates more careful adjustment. When there is more space between objective and slide, the latitude for focusing is greater.

700. **Focusing Adjustment.**—The focusing adjustment for the cheaper instruments consists only of a diagonally cut rack and pinion, with no fine adjustment, while the focusing adjustment for the higher-grade instruments consists of a coarse adjustment by standard rack and pinion (see Q, Illustration No. 124) and a fine adjustment by standard micrometer screw movement, with extra large graduated milled head and pointer for measuring thicknesses of objects (see R, Illustration No. 124). The coarser adjustment on higher-grade instruments serves the purpose of obtaining a rough or approximate focus, and the fine adjustment for getting the more accurate focus. For

all ordinary purposes the coarse adjustment will enable the student to do all his focusing, except when using a high-power objective. The fine adjustment, by the aid of which an almost imperceptible movement may be imparted to the optical system of the microscope, is one of its most indispensable adjuncts. So sensitive are high-power objectives that the slightest alteration of their distances from the object would result in failure. Therefore, high-power work will be quite impossible without the fine adjustment.

701. **Bull's-Eye Condenser.**—This useful piece of apparatus consists of a Plano-Convex lens mounted on an arm sliding on a pillar so that with a little manipulation any required position of the lens may be attained. One of the purposes of this accessory is to illuminate an opaque object by concentrating the light from any source upon the specimen which could not, owing to its opacity, be viewed by transmitted light from the mirror underneath. The bull's-eye condenser is also used to concentrate the rays of light upon the mirror when using artificial light with a high-power objective. Where gaslight is used as the illuminant, the Welsbach gas lamp with bull's-eye lens will be found an improvement over the bull's-eye condenser, as it supplies a more concentrated light.

702. **Eye-Pieces.**—The eye-piece (see F, Illustration No. 120) consists of a couple of Plano-Convex lenses mounted in a metal tube, the lower section fitting flush with the metal tube, while the upper section is made with a milled edge and projects over the tube, thus permitting of the tube slipping into the microscope barrel and resting upon the milled head of the upper section. The Nos. 1 and 2 eye-pieces are marked according to their optical value. The one marked 1 has an initial magnification of ten diameters; the one marked 2 has five diameters. The low-power eye-piece (No. 2) is the most useful to the student and gives excellent results when used with the photo-micrographic camera.

703. **Use of the Yellow Screen.**—Owing to the fact that many slides contain different shades of the same color,

you will require a specially prepared plate or color-screen, which assists in rendering colors in their relative values to each other. For example, some specimens show several shades of red. With a specimen stained from a deep red to a delicate pink, it is evident that in exposing to obtain detail in the dark parts, you will inevitably obliterate the more delicate portions unless some restrainer is employed; hence the use of the yellow screen.

704. The yellow screen, according to its density, corrects the delicate colors; *i. e.*, the screen restrains the action of light upon these colors during the exposure of the more opaque colors, thus giving a more uniform rendering of the different tones. This screen is usually placed just in front of the instrument and supported by the stage. It may be placed anywhere in the path of the light. The exact distance from the stage is of no particular importance, but it simplifies matters to have it lean against the stage, for then you are absolutely certain of cutting out any white light that is not wanted. (See Fig. 1 of Illustration No. 122, which shows the instrument in use for daylight work.)

705. While these filters or screens can be purchased already colored, yet one can very easily prepare their own by immersing two unexposed 5×7 plates in the acid hypo fixing bath, allowing them to remain in this solution until all milkiness or bromide of silver, has disappeared; then wash for half an hour in running water, after which place them in the rack to dry. When dried, immerse the plates in a saturated solution of picric acid for ten minutes, and without washing place them in the negative rack to dry. When dried, place the two film surfaces together and bind the edges with passe-partout paper, when they are ready for use.

706. **Focusing.**—When a convenient and satisfactory illuminant has been selected, the student may begin focusing the slide. The principle of focusing is to adjust its relations to the object on the slide, so that a clear image is obtained. Care must be taken in obtaining the focus and a certain line of procedure must be followed, which,

by practice, becomes habitual. Exercise care that you do not bring the front of the lens (objective) and cover-glass in violent contact, and always begin focusing with a low (two-thirds) objective, as the working distance between the lens and the slide is greater than with the high-power objectives, and the danger of the objective and cover-glass coming in contact is less likely to occur. With the high-power objectives, in which the working distance is so small that the front of the objective is very close to the cover-glass, there is danger of injuring the instrument as well as the slide.

707. In consideration of the foregoing, and until the student has become thoroughly familiar with these principles, focusing should be practiced without the camera attachment and with a two-thirds objective, and always keep in mind the rule previously given, never to use more illumination than is necessary.

708. In obtaining the focus, after the slide has been placed upon the stage under the clips to secure it in position, and the objective is in position, if the instrument is supplied with a coarse and fine focusing attachment, lower the tube by the coarse adjustment until the front of the objective is within one-fourth of an inch of the object. Look through the eye-piece and slowly elevate by the adjustment until the image is distinct. The upward movement should be slow, so that if the object is faint it is not missed and you do not run the lens beyond the sharp focus. The object will first appear with faint outlines, then gradually become more distinct, and finally sharply defined; but if the adjustment goes beyond this point, the object will gradually become dim, in which case return to the point of greatest distinctness.

709. In focusing with higher-power objectives, lower the objective by coarse adjustment until the front of the objective is nearly in contact with the cover-glass. Looking into the eye-piece, slowly elevate the tube with the coarse adjustment until the image appears; then, for final focusing, use the fine adjustment.

710. When racking the adjustment to obtain a focus of the image, it is advisable to slightly move the slide or object in different directions while viewing the image through the eye-piece, as the flitting of shadows or colors across the field will indicate when the objective is nearing the focal point. By this means you also select the portion of the field you desire to photograph. With this accomplished, remove the eye-piece and place it within the cone of the camera, first removing the ground-glass and then slipping the eye-piece into the cone from the upper slide. With the eye-piece in position in the cone of the camera, the barrel of the eye-piece will protrude beyond the end. Next place the camera cone over the tube of the microscope, slipping the eye-piece which projects through the camera cone into the barrel of the microscope, attaching the camera over the tube and fitting it flush with the milled ring, which places the eye-piece in proper position. Then very slightly turn the thumb-screw on the camera cone, to secure the camera firmly to the microscope.

711. Where the more expensive regular extension bellows camera is employed, as shown in Illustration No. 127, the eye-piece is not removed from the microscope in order to attach the camera, but, on the contrary, the camera is fitted with a brass hood which fits snugly over the eye-piece of the microscope and telescopes it sufficiently to exclude all rays of light from entering the camera at this connection. Focusing is then proceeded with upon the ground-glass.

712. When focusing the camera, in place of attempting to look through the glass, as you would when focusing the microscope, you observe the image by looking *upon* the ground-glass, and in order to exclude all light from the surface of the ground-glass, the head and camera should be covered with a focusing cloth, as illustrated in Fig. 1, Illustration No. 126. The image will appear upon the ground-glass screen considerably magnified.

713. In placing the ground-glass into the camera, exercise care that the ground-glass side is downward. This

is essential in order to secure perfect focusing and recording of the image upon the plate. If the ground-glass employed is not sufficiently transparent, it may be made more transparent by rubbing the surface with a mixture of equal parts of alcohol and glycerin. This will make the focusing screen very transparent and serve every purpose. In applying the mixture it is advisable to apply it in a circular motion, and only over the center of the ground-glass, covering a space about the size of the image on the glass.

714. **Use of the Hand Focusing Glass.**—For some high-power work the hand focusing glass may need to be employed. With it you obtain a sharp focus on the central part of the image. Place an ordinary focusing glass, similar to the one shown in Fig. 3, of Illustration No. 126, on the center of the ground-glass and look through it the same as you would when focusing with the eye-piece on the microscope. The focusing glass may be moved about over different portions of the field until a sharp focus is obtained.



Illustration No. 128
Interchangeable Diaphragms for Microscope
See Paragraph 715

715. **Diaphragms.**—For the cheaper instruments which are not fitted with the Abbe condenser diaphragms, a little more depth of focus can be obtained by applying an interchangeable diaphragm in the tube of the microscope. These diaphragms may be made of black paper and can be supplied with different size openings. (See Illustration No. 128.) To insert these diaphragms, remove the eye-piece and inner tube from the microscope and slip the diaphragm down in the tube, resting on a metal diaphragm, which is present in this outer tube. These diaphragms are

easily made. In order to obtain the actual measurements, place a piece of black paper on the top of the outer tube, and with the finger crease the outline of the tube; then, with a pair of shears, cut to the outline. Next, perforate the center, being careful that the hole is perfectly round. Illustration No. 128 will give you an idea of the size opening required. It is needless to state, that the smaller the opening the sharper the image, requiring a correspondingly longer exposure. When the high-grade instruments fitted with an Iris diaphragm in the Abbe condenser are used, the interchangeable diaphragms are not necessary. For all ordinary work, the diaphragms are really *unnecessary*, but where great precision is required in the focusing, they are almost indispensable.

716. Photo-Micrographic Camera for Laboratory Use.

—In Illustration No. 127 we present one of the latest photo-micrographic cameras, made by the Bausch & Lomb Optical Company. This is a very practical instrument, and is designed to meet the requirements of medium-power work in any laboratory. The strength, simplicity, serviceability and convenience of manipulation are at once apparent, and attention is directed to the fact that but one vertical bed is employed, thus giving a much greater latitude for work, as compared with those models using two upright rods.

717. The camera consists of a heavy metal base 9 4-5 x 13 inches, upon which a movable plate 8 x 6 inches is mounted and secured with a clamp. This plate has a movement of $4\frac{3}{4}$ inches, thus allowing the microscope, which is clamped to it, to be removed from the axis for examining a slide and then quickly returned to the proper position. An adjustable clamp is mounted on the plate, and by this means any microscope may be secured in place and accurately centered, the clamp and the plate permitting movement in two directions.

718. The vertical bed, 25 3-5 inches long, is graduated throughout its length and is mounted on the base with a joint having its bearing surface in the shape of an arc. A clamp secures the vertical bed at any angle between the

horizontal and vertical positions. This camera can, therefore, be used in a vertical position to photograph objects which must be held in a horizontal position, such as specimens in solution, or may be inclined at will to meet any conditions.

719. Upon the vertical bed two frames are supported by standards held in a T-shaped slot by clamps. The first frame carries either the front board with tube adapter for the microscope or a shutter and this adapter. The bellows, which have a cross section of $4\frac{3}{4} \times 6\frac{1}{3}$ inches, are attached to the rear of this frame and extend to the rear frame. They are long enough to accommodate work at any distance along the bed.

720. The rear frame carries a camera box of unique design. At the back a hinged cover with two springs permits the plate-holder to be laid into place, and then gently but firmly pressed into exact position, bringing the plate into focus without jarring the apparatus. This is most essential in high-power work where the focus must be exact. The focusing screen of ground-glass, with clear center, slides in two grooves in the camera box, and is, therefore, always used in the same position.

721. The finish throughout is dull black, excepting the bearing surfaces, thus preventing reflections as far as possible. A double plate-holder for two 4×5 plates, with kits for $3\frac{1}{4} \times 4\frac{1}{4}$ plates, is included in the outfit.

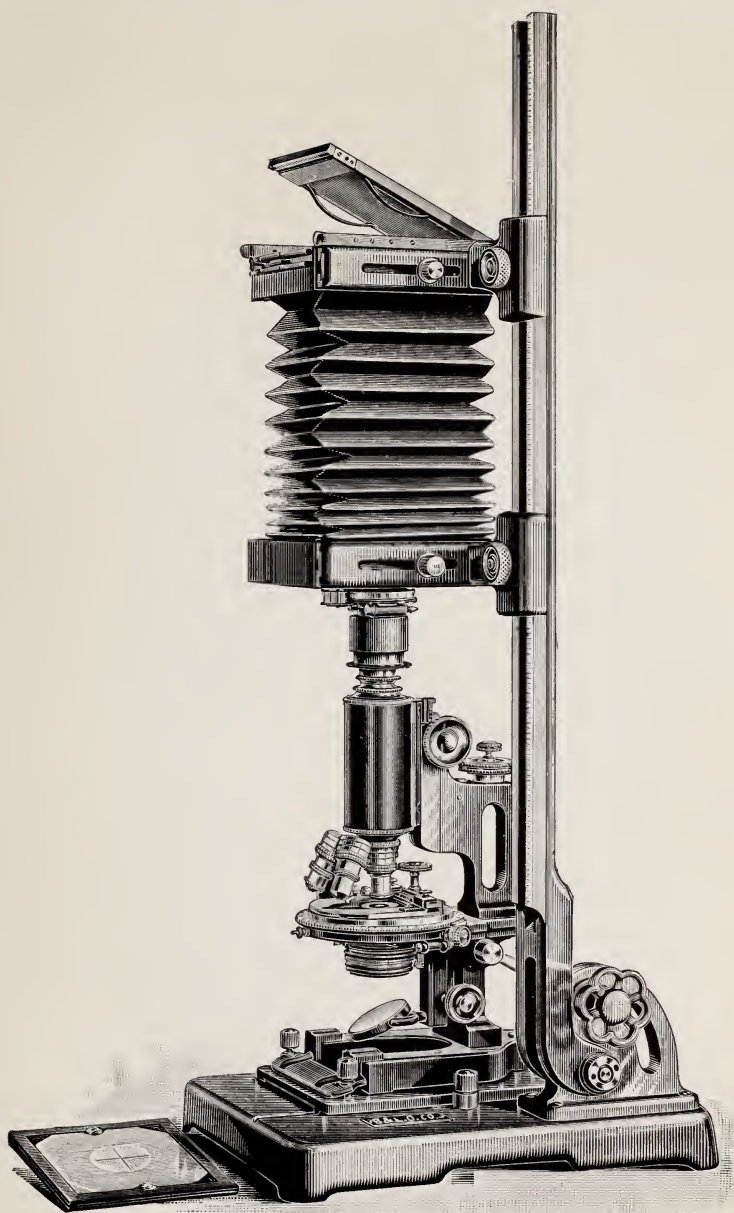


Illustration No. 127
Bausch & Lomb Photo-micrographic Camera for Laboratory Use
See Paragraph 711

CHAPTER XXXIV.

Photo-Micrography.

Practical Manipulations for the Beginner.

722. **Daylight Exposures.**—After becoming familiar with the operating of the microscope, the manipulating of the accessories and focusing of the camera, etc., you will be sufficiently experienced to proceed to the final and very important stages of exposure and development. For your daylight work, arrange the microscope and camera attachment, as in Fig. 1, Illustration No. 122, using the two-thirds objective and No. 1 eye-piece. A suitable subject should be selected. For your first experiment, the wing of a common house-fly will supply you a very good subject.

723. After killing the insect, carefully detach one of the wings and place it on a clean glass slide. Cover the wing with a thin cover-glass, and fasten the cover-glass in position with two narrow strips of gummed paper. With the specimen prepared, place the slide on the stage, securing it in position under the nickel clips. With the camera attached to the microscope, you are now ready to focus the image. With the focusing adjustment bring the objective to within one-fourth inch of the slide. The focusing must now be viewed upon the ground-glass screen.

724. Place the focusing cloth over the head and camera, excluding all light from the ground-glass. First begin by manipulating the mirror (using the plano side) to illuminate the subject. After securing even illumination, begin focusing by racking the objective upward by means of the milled head adjustment attached to your focusing rack and pinion. The focusing must be done slowly and carefully, and while turning the focusing screw observe care-

fully the image as it appears on the ground-glass. The subject will present the appearance of a delicate membrane studded with minute hairs and traversed with thick membrane. A fringe of very fine hairs will be found edging the wing. If they are of a foggy appearance and do not focus sharply, too much illumination is being used.

725. If the microscope is of the cheaper variety and has not the sub-stage or Abbe condenser fitted with an Iris diaphragm, then arrange the microscope and camera farther from the source of light, or insert in the tube of the microscope the second size of the interchangeable diaphragms. This latter method is preferable to the former, for the diaphragm will assist in giving you a greater depth of focus. Where the better grade of instrument is employed, which is fitted with the Abbe condenser and Iris diaphragm, reduce the illumination with the Iris diaphragm. This concentrates the light upon the object, and when diaphragmed to the correct stage the image will stand out sharply defined without any appearance of fuzziness.

726. There being two diaphragms to the condenser, the upper one, or one next to the stage, may be used with the smallest opening, providing it covers the field. The lower diaphragm cannot be used with so small an opening, for then it would cut off the illumination on the edges of your object. This diaphragm should be adjusted so that the opening is sufficiently large to admit the entire field into the view. The exact size can only be ascertained by trial, viewing the image first through the eye-piece before attaching the camera. With the proper stop selected and the camera attached, the image may be focused on the ground-glass.

727. When the focus has been obtained, carefully slip out the ground-glass screen and insert the plate-holder in its place, exercising great care that you do not jar the instrument during this procedure.

728. The safest way to insert the plate-holder is to hold the camera firmly with the left hand while inserting the plate-holder with the right. This will avoid jarring.

The proper inserting of the plate-holder without jarring the image is of utmost importance, and one can do no better than to practice this portion of the work, without making exposures, for, strange as it may seem, the very slightest jarring of the instrument may change the focus of the light upon the image to be photographed. For this reason a very rigid and substantial table upon which to rest the instrument during exposure, is necessary.

729. **Plates.**—While, ordinarily, we would recommend the use of orthochromatic plates for all microscopic work, yet for this class of work and for first experiments any ordinary plate will answer—one having a slow emulsion preferred. The object of using orthochromatic plates is to preserve the relative color values that exist in different objects to be photographed. Wherever such values exist, either an orthochromatic, or even a trichromatic or panchromatic plate, which is sensitive to all colors, should be used; but for plain work void of colors, the ordinary or double-coated non-halation plate will answer every purpose.

730. **Exposure.**—With the camera and plate-holder in position, the next in order would be the making of the exposure. The cheaper photo-microscopic cameras not being fitted with a shutter, some means must be employed whereby the illumination may be shut off from the object being photographed. A very simple arrangement will be found in the use of an ordinary cardboard, say 10 x 12 inches, made V-shape so that it will stand erect. This can be accomplished by bending the cardboard in the middle. This will hold the card in position and permit of it standing without any support. When ready to make the exposure, place the cardboard before the stage and in the path of the light, excluding all light from the object on the slide. You are then ready to make the exposure, the length of which depends upon the density of the object being photographed and the strength of the illumination.

731. With the fly-wing specimen if daylight is used you will require about five seconds exposure; with Welsbach light, thirty seconds. Now, with the shutter before

the instrument, excluding all direct rays of light from the object, very carefully withdraw the slide on the lower section of your double plate-holder. After withdrawing the slide, wait a moment until all vibration has ceased, then carefully withdraw the cardboard shutter from in front of the stage for the necessary length of exposure and again replace, after which insert the slide and the exposure is completed.

732. Use of Welsbach Gaslight.—In Fig. 1 of Illustration No. 124 we show the use of the Welsbach light in connection with the bull's-eye condenser, for photographing the same object. While in this illustration we show a high-grade microscope, yet the same arrangement will answer with a cheaper instrument, and while gaslight illumination may be employed without the bull's-eye condenser, yet this instrument will add materially to the evenness and strength of the illuminant. By its use you can better concentrate the light upon the object. None of the accessories appearing in this illustration, with the exception of the light and the bull's-eye condenser, are to be used in this instance.

733. You will observe that the bull's-eye condenser is arranged on a perfect line between the light and the mirror of the microscope. The condenser is tilted at an angle to concentrate the light from the lamp upon the mirror. This light is collected on the mirror and, in turn, is reflected upward through the slide on the stage. With this accomplished, the remaining manipulation, such as focusing of the image upon the ground-glass, etc., is exactly the same as for daylight work. The only difference between the use of artificial light and daylight lies in the exposure. Owing to the fact that artificial light is less actinic, it requires a longer exposure. Usually the exposure with a Welsbach light, where the bull's-eye condenser is employed, will require double the exposure necessary for daylight work.

734. Reproducing Colored Objects.—The nature of the illuminant for reproducing colored objects is immaterial.

Exactly as good results can be produced with artificial light as with daylight and, in fact, if any preference is given, it should be in favor of the artificial light, for the reason that there is more latitude in the exposure. For our next subject, we have selected a double-stained slide, which represents protoplasm. The colors range from a slight pink to a deep red with some blue. It is evident that if sufficient exposure were given to obtain detail in the dark parts of the image, the lighter or more delicate portions would be entirely obliterated. In order to overcome this obstacle and produce the colors in their relative values, we used a yellow color-screen, as previously explained and as illustrated in Fig. 1 (J), Illustration No. 124. This screen is placed before the microscope as shown in Fig. 1, Illustration No. 122.

735. With the screen in position the focusing and other manipulations are exactly the same as previously instructed. You will observe, when focusing the image upon the ground-glass, the light being diffused through this screen, that the image does not appear as strong, but the outline is more clearly defined and the relative values are more apparent than if the screen were eliminated entirely. When using the screen, whether for daylight or artificial light, the exposure is again prolonged. Usually, from three to six times the exposure is required, all depending upon the density of the screen. The lighter the color of the screen, the shorter will be the required exposure, but, at the same time, the greater will be the loss in color values. The darker the screen the longer the exposure and the better the color values produced. Therefore, a medium color-screen should be employed, one that can be used universally for all purposes—usually a three, or even a four-times screen is selected. A screen dyed according to instructions given in the previous chapter will supply you with the right color.

736. **Plates to Use.**—Having retained the relative color values upon the focusing screen, your next endeavors must be devoted to recording these same values upon the sensi-

tive plate. As previously stated, we have learned that the ordinary plate is not corrected to a variety of colors. Therefore, we must employ specially prepared plates which are sensitized and corrected expressly for the preserving of color values. Such a plate will be found, to a certain degree at least, in the orthochromatic, and for the best results the orthochromatic slow plate is recommended. However, the rapid orthochromatic plate may be employed. In Fig. 3, Illustration No. 129, we present the results which were made on a rapid orthochromatic plate, used in conjunction with a color-screen, giving an exposure of six seconds.

737. **Opaque Illumination.**—In Fig. 4, Illustration No. 129, we present the results of an opaque illumination. For this subject we selected a strip of linen, stretched it across the stage and held it firmly by means of the nickel clips. When viewing this linen by light transmitted from the mirror through the linen, an interlaced, rope-like effect, with bright spots of light, is seen. If a picture of the linen were made with transmitted light, as above explained, the photograph would not show the texture of the fabric but each thread would be represented by shadow outlined with light, which was admitted between the threads when reflected through the goods into the camera. By changing the position of the mirror, so that no light is transmitted through the opening in the stage, and by elevating the bull's-eye condenser, adjusting it to the light so as to throw the rays downward and directly upon the object on the stage, we obtained a good view of the surface.

738. In order to give an even illumination to the goods, we employed a back reflector, as previously described and illustrated in Fig. 1, (H), Illustration No. 124. This reflector, receiving the full rays of light coming from the illuminant, reflects back upon the object, thus giving double illumination. Now, upon again viewing the image on the ground-glass, we find a very pretty effect and an accurate rendering of the fabric. Instead of the dark lines, as would be the case if transmitted light were used, we obtained an interlaced white rope-like effect with dark spots, which

gives it a magnified natural appearance. For this subject we employed a non-halation or double-coated plate, the object being to avoid halation. The linen being white, unless a non-halation plate were employed, the results would be quite harsh, lacking in roundness, while with the non-halation plate we preserved all the half-tones and soft detail.

739. Photographing a Bacteria Slide.—The photographing of bacteria is quite distinctive from the ordinary use of the microscope, and this class of work is mainly interesting to physicians and those interested in medical research. The two-thirds and one-sixth objectives, with their proper eye-pieces, are capable of giving satisfactory photographs of animal tissues, both normal and diseased. The high-power 1-12 oil-immersion objective, with its magnification of one thousand diameters, with either No. 1 or No. 2 eye-piece, is almost universally adopted by the scientific world as being sufficiently high to show very clearly the minute forms, such as blood and pus corpuscles, germs, bacteria and cell structure. For bacteriological work the slides are usually stained with methyl-blue and carbol-fuchsin. These stained slides necessitate the use of the color-screen during exposure.

740. To begin focusing and finding the field, the two-thirds objective should be used and the preliminary focusing should be done without the camera attachment. The method of focusing is the same as previously given, excepting that more care must be given. Every movement must be made quietly and deliberately.

741. After placing the slide upon the stage of the microscope, the field is found with a two-thirds objective, having the Abbe condenser wide open. When the field is found, before changing to a higher-power objective, first, with the coarse adjustment, slightly raise the microscope tube from the slide. Remove the two-thirds and insert the one-twelfth objective. As all three objectives are attached to the revolving nose-piece, all that is required is to turn the objective into position, when you are again ready for focusing.

742. Proceed by placing a drop of cedar oil upon the cover-glass of the slide. With the coarse adjustment lower the 1-12 objective until it comes in immersed contact with the slide; then, observing the image through the eye-piece, finish focusing with the fine adjustment, moving the slide about on the stage until a satisfactory field is found. With this obtained, slightly raise the objective from the slide. This is done to avoid any possibility of the objective and slide coming in contact while attaching the camera.

743. With the microscope raised, proceed to attach the camera to the barrel. Insert the ground-glass and again place another drop of cedar oil on the slide, then lower the objective until it becomes immersed in the oil. Now, covering the head and camera with the focusing cloth (see Fig. 1, Illustration No. 126), observe the image upon the ground-glass. Use the hand-focusing glass and focus with the fine adjustment of the microscope, until the image becomes perfectly sharp. Then very carefully remove the ground-glass without disturbing the instrument a particle and insert the plate-holder, when you are ready to make the exposure.

744. Before drawing the slide, place the cardboard between the light and stage of the instrument, so as to cut off all illumination. With this done, draw your slide and, after pausing for a few moments until everything is perfectly quiet, gently withdraw the cardboard, thereby making the exposure. When the exposure is completed, again replace the cardboard, thus cutting off the illumination. Follow this immediately by re-inserting the slide in the plate-holder.

745. **Developing.**—The ordinary methods for developing, fully described in Volume II, apply as well to the development of plates exposed through the microscope. Where one is not equipped with the paraphernalia necessary for the regular dark-room, the outfit described in this chapter, under the heading of Dark-Room, will be required.

746. Owing to the fact that for all color slides, especially bacteriological work, the orthochromatic plate must

be used, and as this plate is sensitive to all kinds of light, extreme care must be exercised in providing an absolutely light-tight dark-room, and the developing must be done as far away from the developing light as possible. For convenience, the trays should be used a trifle larger than the plates to be developed. Where the regular developing outfit is not at hand, three trays may be employed. In the first tray place the developer; in the second, provide plain water, and in the third, hypo or fixing solution. Hard rubber trays are preferable for developing, their lasting qualities being far superior to all others, and there is less danger of spots or stains.

747. While any of the developing formulæ in Volume II may be applied to this work, yet it is advisable to employ the formula supplied by the manufacturer of the brand of plates you are using. A good, all-around developer for this work will be found in the following formula:

748. Edinol-Hydro Developer.—

Water	7 ozs.
Sodium Sulphite (Anhydrous)	150 grs.
Edinol	30 grs.
Hydroquinon	15 grs.
Sodium Carbonate (Anhydrous)	300 grs.

For use, take 2 ounces of this solution and dilute with 2 ounces of water. This developer has no poisonous influence upon the skin and will not stain the fingers.

749. **Hypo Fixing Bath.**—The hypo fixing bath is prepared as follows:

Solution A.

Water	48 ozs.
Hypo	1 lb.

Solution B.

Water	16 ozs.
Chrome Alum	1 oz.
Sulphuric Acid, C. P.	2 drms.

Solution A: Dissolve the hypo in the water. Solution B: Dissolve chrome alum in the water. Then, carefully add the sulphuric acid, constantly stirring while adding. When the chrome

alum is dissolved, pour *Solution B* into *Solution A*. This solution remains clear even after continued use, and should be thrown away when it becomes discolored.

750. **Developing.**—With your developer and fixing bath prepared and your ruby light turned low, remove the plate from the plate-holder. In doing so, stand with your back to the light, so as to shield the plate from the light. Place the plate in the developing tray, rocking gently for a moment, then cover the tray with a piece of dark cardboard. Do not examine it for at least two or three minutes, or until development is very nearly completed, and then only by very feeble ruby light, or at some distance from the ordinary ruby light, and only a second at a time.

751. When you consider the negative fully developed, the plate can then be examined nearer the light. If, upon examination, however, you find it is not completely developed, return it to the tray and again cover with the cardboard. When the development is completed, rinse the plate in clean water, to remove the adhering developer, and place in the hypo tray; allow the plate to remain in this solution for at least fifteen minutes, or until all milkiness has disappeared; then, place in the washing box and allow to wash for at least a half an hour. If no running water is at hand the plate can be placed in a tray of clean water for three or four minutes; then, pour this water off and pour clean water on again, repeating this operation ten or twelve times, which should be sufficient to eliminate all hypo from the plate. Just before placing the plate in the rack to dry, swab the surface with a wad of absorbent cotton, which will remove any dirt that may have adhered to the surface.

752. When orthochromatic, trichromatic or panchromatic plates are to be developed, which for best results should be in total darkness, a negative developing tank will be found very convenient. A small tank should be used—one holding but six plates 4×5 or $3\frac{1}{4} \times 4\frac{1}{4}$. Such a tank will only require about 12 ounces of developer and the plates may be placed in the tank in total darkness. If

the factorial method is employed, when you learn the time required for developing one plate, with a particular developer, you practically have a line on all plates developed with that formula, with the bath at the same temperature. But, it is advisable, even when the factorial method is employed, to examine the plate quickly by a weak light, before placing it in hypo, and if it does not contain sufficient strength place it back in the tank for further development. By the tank method you will not only avoid fog, but will also save the edges of the plate from becoming damaged by handling.

Illustrations. How Made.

753. In order to give the reader a clearer idea of the manner of producing results with the microscope and the manipulation of the instrument generally, we supply herewith some illustrations of different negatives made under different conditions, beginning with the most simple studies for the beginner and the more difficult ones for the advanced worker.

754. In Fig. 1, Illustration No. 129, is shown the **Wing of a Fly**. For this exposure a No. 1 eye-piece with a $\frac{2}{3}$ objective was used, the illuminant being gaslight. The plate employed was a Standard Orthonon, which was given 30 seconds exposure, and developed with metol-hydroquinon. The object in using a non-halation plate was to avoid halation. The subject being monochrome—black and white—there was no necessity for orthochromatic or color corrected plates being used.

755. In Fig. 2 we have **Protoplasm and Nucleus** showing chromatic threads. In this exposure a No. 1 eye-piece with a $\frac{2}{3}$ objective was used. The plate employed was an Orthonon, with a color-screen. The exposure given was two minutes, with gaslight illumination. The color-screen was used, owing to the color being blue and red, the yellow screen correcting the blue, giving uniform tone throughout.

756. In Fig. 3 we have the **May Apple Ovaries**. A

No. 2 eye-piece with a $\frac{2}{3}$ objective was used and a daylight exposure given, using a Cramer slow isochromatic plate with a yellow color-screen. The object was dark pink in color. The exposure given was three minutes.

757. Fig. 4 is an illustration of Opaque Illumination, showing the **Threads of a Linen Handkerchief**, which was stretched across the stage of the microscope, the light from a gas lamp being thrown upon the surface of the linen through the bull's-eye condenser. In this case an Orthonon plate was used and two seconds exposure given. A No. 1 eye-piece with a $\frac{2}{3}$ objective was employed. The outfit arranged for making this picture is the same as illustrated for opaque illumination.

758. Fig. 5. **Adeno-Fibroma** (Tumor of Breast). In photographing this subject the No. 1 eye-piece with a $\frac{2}{3}$ objective and gas illuminant were used. Upon viewing the subject through the microscope several shades of blue were visible, from very light to very dark. To tone down these contrasts the dyed yellow screen was used and a Cramer slow isochromatic plate was employed and fifteen seconds exposure given. The developer was metol-hydroquinon.

759. Fig. 6. **Granulation Tissue**. For this picture the No. 1 eye-piece and the $\frac{2}{3}$ objective were used. The microscopic slide from which this picture was made was evenly stained a red color, and in making the exposure with gas illumination the dyed color-screen was employed. The plate used was a Cramer slow isochromatic, and thirty seconds exposure was given, using metol-hydroquinon for developing.

760. Fig. 7, Illustration No. 130. **Adenoma of Thyroid Gland**. (Tumor of Neck). This specimen shows different shades of red. The color-screen was used with gas illumination, and No. 1 eye-piece and $\frac{2}{3}$ objective employed. Cramer slow isochromatic plate was used, and thirty seconds exposure given. This plate was developed with edinol-hydro developing solution.

761. Fig. 8, Illustration No. 130. **Malignant Oedema**

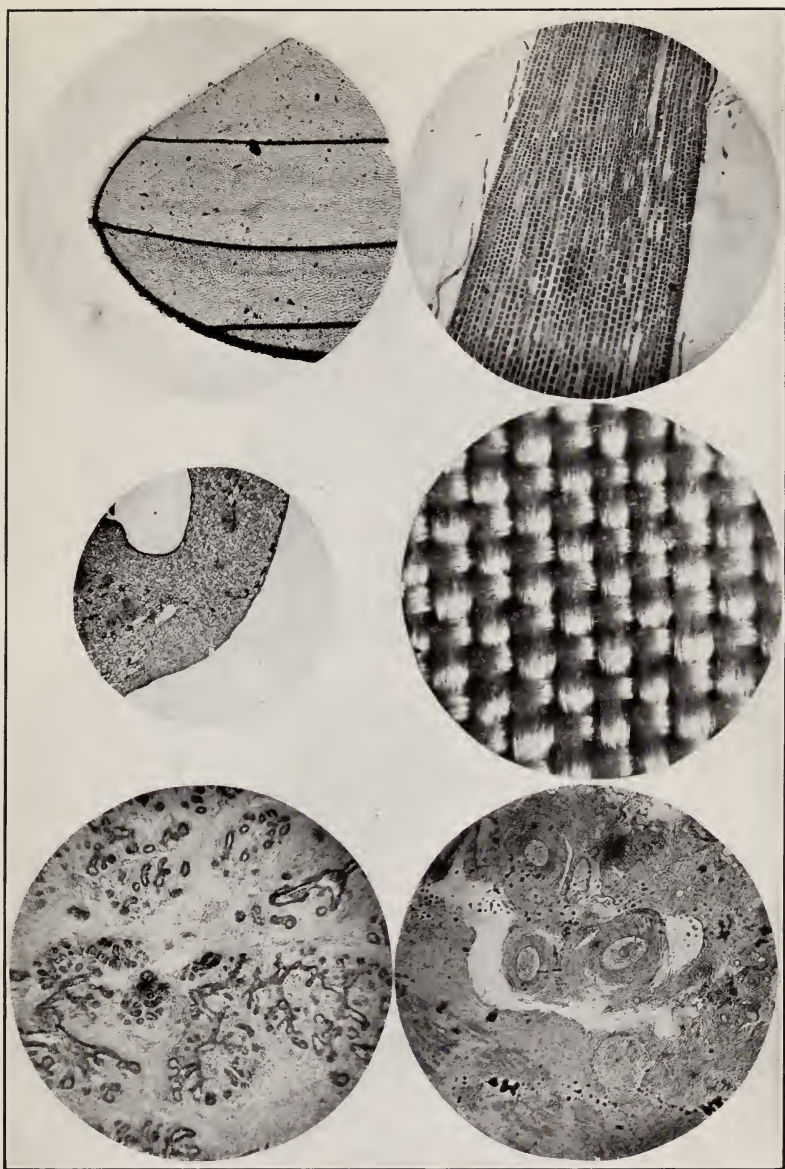


Illustration No. 129
 Reproductions from Microscopic Slides
 See Paragraph 754

Fig. 1. Wing of Fly

Fig. 3. May Apple Ovaries

Fig. 5. Adeno-Fibroma
 (Tumor of Breast)

Fig. 2. Protoplasm

Fig. 4. Example of Opaque Illumina-
 tion—Linen

Fig. 6. Granulation Tissue

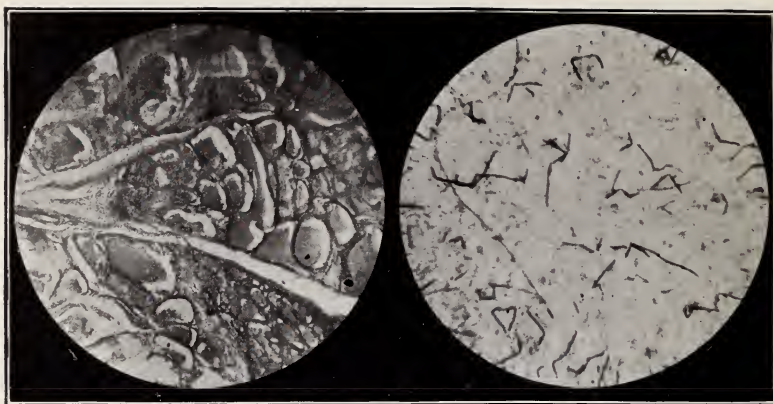


Fig. 7. Adenoma of Thyroid Gland
(Tumor of Neck)

Fig. 8. Malignant Odema Bacilli
(Gas Bacillus)

Illustration No. 130
Reproductions from Microscopic Slides
See Paragraph 760

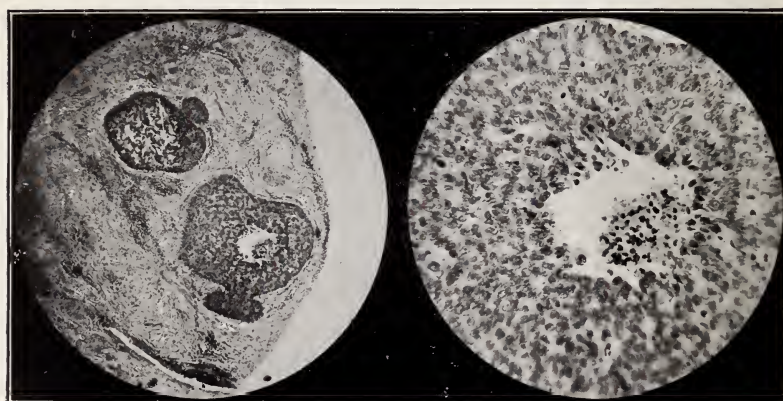


Fig. 9. Adeno-Carcinoma
(Cancer)

Fig. 10. Section of Fig. 9 Magnified

Illustration No. 131
Reproductions from Microscopic Slides
See Paragraph 764

Bacilli. Gas Bacillus. This bacteria photograph is mentioned under the note on Bacteria. This slide has two shades of blue, very light and very dark. The No. 1 eye-piece and the 1-12 oil-immersion objective were used with gaslight illumination. An Orthonon plate was employed with the color-screen, and an exposure of four minutes given. The developing was effected with an edinol-hydro solution.

762. In Figs. 9 and 10 of Illustration No. 131, we present the results obtained with a Bausch & Lomb Photomicrographic camera, as used by Mr. Herman Shapiro, of Johns Hopkins' University, Baltimore, Md. This photomicrographic camera is shown in Illustration No. 127. Mr. Shapiro has devoted most of his attention to the use of the low and medium-power objectives ($\frac{2}{3}$ and 1-6) for work in histology, embracing from a 25 to 300-times magnification, and rarely 500. Higher power he employs principally for bacteriology.

763. Mr. Shapiro prefers working by daylight. He has his camera arranged on a table within two feet of a north window, and with a few plate holders loaded he is always ready for work, and it is merely a matter of from five to ten minutes for him to obtain a record, his exposures varying from ten seconds for low power ($\frac{2}{3}$) objective without ray screen to two minutes for high power (1-12) with yellow four-times screen, on an image covering a 4 x 5 plate. His large sizes he makes by enlargement, with a saving of time and money, and in addition the enlargement may be subjected to legitimate strengthening with India ink and Chinese white.

764. In Fig. 9 of Illustration No. 131, we have an **Adeno-Carcinoma** (cancer of a female breast). This illustration shows two areas of breaking down carcinoma. The picture was made with a low-power ($\frac{2}{3}$) objective, using a No. 3 eye-piece, and with the camera extended 14 inches, producing a picture $3\frac{1}{2}$ inches in diameter. The plate used was an orthochromatic, with a ten seconds exposure without a screen.

765. In Fig. 10 of Illustration No. 131, we have a magnification of the larger of the two areas exhibited in No. 9, showing very clearly the large **Cancer Cells**, with central clean space of necrotic or dead tissue. In making this illustration a 1-12 oil-immersion objective was employed, with a No. 3 eye-piece, and the camera extended 14 inches, producing a picture $3\frac{1}{2}$ inches in diameter. For this purpose an orthochromatic plate was used, with a four-times screen, requiring one and a half minutes exposure.

CHAPTER XXXV.

Photographing Microscopic Slides for Lantern-Slide Work.

766. While lantern-slide plates are frequently made from microscopic enlargements, yet, owing to the lack of distinct sharpness to the very edge, slides made from these plates do not always give satisfactory results, and as the slide itself is many times enlarged when thrown upon the screen, the image on the slide does not require such enormous magnification.

767. By means of an ordinary long-bellows camera and a small-size lens, such as a No. 000 Goerz Dagor, which has $2\frac{3}{8}$ -inch focus, the specimen on the microscopic slide may be enlarged sufficiently for lantern-slide use and every portion of the specimen can be made critically sharp. Of course, where minute parts of a section of the specimen are desired, the enlargement will need to be made through the microscope; but very often fair-sized sections of a specimen only are required. In such cases the use of the ordinary long-bellows camera fitted with a small-size lens, such as the Goerz Dagor, will serve best.

768. A simple method for enlarging a specimen is illustrated in Fig. 2, Illustration No. 122. Herein you will observe the specimen slide is attached to an ordinary piece of cardboard, which latter contains an opening slightly larger than the outside measurement of the specimen itself. The opening should be about the size of the cover-glass, which is about $\frac{3}{4}$ of an inch. The specimen may be attached to the cardboard by means of pins inserted

through the cardboard at an angle, at the top and bottom of both ends of the slide, just sufficient to hold the slide in place.

769. If one has a copying-board arranged as described and illustrated for *Negative Enlarging and Lantern-Slide Making* in Vol. V, then all that will be required is to insert the cardboard in the printing-frame and place the latter in the slide provided for holding it. You are then ready for the enlarging. If, however, you are not equipped with this outfit, Fig. 2, Illustration No. 122, shows a very simple method for copying that will enable one to produce as good results, requiring, of course, a little more care in adjusting the camera to the proper stage so that it may be on a perfect line with the slide.

770. An ordinary table may be employed for the purpose of receiving the slide-holder and the camera, as the instrument is more easily adjusted when working on a level surface. Begin the work by first placing the slide-holder (or printing-frame containing the slide) on the edge of the table before the window. Place the camera on a line with the holder. Draw out the bellows very nearly its full length; adjust the front-board by raising or lowering until the lens faces the exact center of the slide or that portion of the specimen you wish to reproduce. Arrange the camera so that the lens will be located about three inches from the slide, and with the bellows drawn to almost its full length you will find, upon focusing, that you will have an image large enough for a lantern-slide. The longer the bellows extension, of course, the larger the image will be on the ground-glass, and the shorter the focal-length of the lens the closer you can work to the subject, and as is usual, the smaller the size of the lens the shorter the focus; therefore, a lens only sufficiently large to cover the size object which you have to photograph is required.

771. If only microscopic slides were to be reproduced, the smallest size lens made could be employed. But there are other uses to which the lens can be put—for instance, the photographing of larger objects than those contained

in the microscopic slide—and the one lens can be made to answer for all purposes. Therefore, we recommend the No. 000 Goerz Dagor lens, with an equivalent focus of $2\frac{3}{8}$ inches, covering a plate $2\frac{3}{8} \times 2\frac{3}{8}$, as that will answer every purpose. This lens permits of working quite close to the object. It also allows of the use of the ordinary hand camera with good bellows extension.

772. **Focusing.**—With the camera placed on an exact line with the microscopic slide and the bellows extended, you can obtain the focus by racking the bellows of the camera to and from the object. Should the image not be sufficiently large, you obtain a larger image by sliding the camera closer to the object and extending the bellows longer. The largest image that you can obtain will depend on the focal-length of your camera.

773. **Stopping.**—As good sharp detail is required, the lens should be stopped down at least to F. 32, and in some cases still smaller openings should be employed. The same plates should be used for this class of work as you would use when photographing with a microscope, for the same values must be retained. For all ordinary work the regular lantern-slide plate may be used. For special work, where the relative color values are of importance, the slow orthochromatic plate will be found an improvement.

774. **Dissecting Subjects for Photo-Micrography.**—Some subjects (such as flowers) must be dissected. Fig. 2 of Illustration No. 126, page 352, shows the method of using the microscope for this operation. Some difficulty may at first confront the student, owing to the object being inverted, as the work will be performed opposite to that naturally done without a microscope. The slides for dissection are made by flowing them with a thick liquid solution of gum arabic and allowing to dry. By breathing upon the dry slide it will become sticky enough to make the subject adhere for dissection. The $\frac{2}{3}$ objective is mostly used, as there is a good working space between objective and slide.

775. **Printing and Finishing.**—The making of prints from photo-micrograph negatives is usually done on glossy printing-out paper, or on glossy developing (gaslight) paper. Generally, the latter is employed, as it is the most convenient to use and quicker results are obtained, and for the busy man this is quite important. Another convenience, especially where artificial light is used for making the negatives, lies in the fact that the same illuminant may be employed for making the prints. For the manipulation of the different printing papers, see Vol. IV.

CHAPTER XXXVI.

Making Post-Cards for Quick Delivery.

776. The Post-Card Business at Resorts.—With the advent of the developing post-card, an enormous and profitable business has sprung up in the making of post-card photographs for immediate delivery at the various summer and winter resorts. Such photographs are, of necessity, of no high order of pictorial merit, but they generally have the saving grace of being good likenesses, and from their inexpensiveness alone, the demand is practically inexhaustible.

777. System Required in Making Post-Cards for Quick Delivery.—It is quite essential to have a method or system of producing post-cards as quickly as possible in summer resort, county and street fair galleries, etc. By following the instructions and using the system herein described, and with some little practice, you will be able to accomplish this with ease and considerable profit. These instructions will lead you, step by step, from the developing of the plate to the finished post-card. They will also include the manner of conducting the business and establishing a system of working.

778. Required Outfit—Camera and Lens.—Any ordinary small portrait or view camera fitted with double plate-holders may be employed. The holders should be provided with kits to enable you to use smaller plates. The lens should be a rapid one of short focus.

779. Where a business is made of post-card work and plates 5×7 or $4\frac{1}{4} \times 6\frac{1}{2}$ are used, there is no outfit so convenient as the regular portrait outfit with cabinet attachment, with which any number of plate-holders may be employed.

780. **Developing Tanks and Trays.**—You should provide yourself with at least two hard rubber tanks, the size of plate you are going to use—one for developing and the other for the hypo fixing bath; one large tray for fixing post-cards (the larger the tray, the better); one 8 x 10 developing tray; and one 8 x 10 tray for acid clearing bath.

781. **Plates.**—Any low-priced brand of quick plates will serve. Some manufacturers now offer a special post-card plate, which can be bought very cheaply in quantities.

782. **Post-Cards.**—The choice of a card lies with the individual, some having a preference for one make and others for another. Generally, a fairly hard surface card, semi-matte or matte is used, one that will give brilliant results and will work clean. For special information on the different brands of post-cards and their particular qualities we refer you to Volume IV. When the cards are bought in lots of 5000 or over, the manufacturers will generally print the photographer's name, or the name of the resort, on the back of the card, without extra charge.

783. **Studio Fittings.**—Few pretensions are made in the way of style in a post-card studio of the nature found in resorts. Most of the elaboration is on the outside, which should be made as attractive as possible, with the showcase and business counter either right at the entrance or in full view from the outside. Inside the studio, which need not necessarily be enclosed from general view, there should be little more than a chair or two, the camera, backgrounds, some stucco rocks, railings, or whatever strikes the owner as being most suitable for the customers to sit or lounge on while being photographed, and possibly some extra accessory in the shape of an automobile shell, etc.

784. **Backgrounds.**—The backgrounds should be suitable to the location of the gallery. A pier or beach scene for a seashore resort; a mountain or waterfall background for the mountains; a chute-the-chutes scene for an amusement park; and so on. It would be absurd to place your customers before a background of waves and beach if the gallery is situated in the mountains.

785. A line of comic backgrounds, to be placed in front of, and showing only the head of, the customer, with some absurd drawing for the body, are often profitable in a well-frequented resort.

786. **Artificial Lighting.**—As most of the business at such resorts is done in the evening, it is always well to have the gallery fitted with some source of strong artificial light. The new Tungsten incandescent bulbs are economical, and are capable of giving a very strong light for the amount of current consumed. The Aristo lamp, which has been fully described in Volume VI, is frequently used; also the Cooper-Hewitt tubes, which are more economical and give greater actinic light. A complete outfit of tube, rheostat, extra tubes, etc., will cost in the neighborhood of \$50.00, according to the length of tube employed.

787. **Lighting and Exposure.**—The background and camera should be arranged to the light—daylight or artificial—to give as broad a lighting as possible. This gives the greatest roundness and smoothness to the face, which is important, as there is no time for, nor profit in, retouching the negatives. One should aim at over rather than under-exposure.

788. **Developing of Plates.**—Time saving being the most important feature it is necessary to employ a rapid developing agent. The following combination of metol and hydroquinon (ortol can be substituted for metol, using the same proportion) will develop the plate in from three to ten minutes. The speed of the bath can be changed by the addition of water. The more water added the slower the bath will develop.

789. **Formula.**—

Water	100 ozs.
Metol	$\frac{1}{2}$ oz.
Hydroquinon	2 ozs.
Sulphite of Soda (anhydrous).....	8 ozs.
(if crystals are used, 16 ozs.)	
Carbonate of Soda (anhydrous).....	12 ozs.
(if crystals are used, 24 ozs.)	
Bromide of Potassium (crystals).....	$\frac{1}{4}$ oz.

790. The chemicals must be dissolved in the order named, and the solution stirred constantly while adding. This is a concentrated developer, and if put up in a demijohn will keep for several weeks. It will keep indefinitely if put up in bottles, filling the bottles to the cork, being careful that they are well stoppered. A cork stopper, dipped in hot wax is the best.

791. After your stock solution has been standing for several days, a slight precipitation may occur. This, however, will do no harm and perfectly clean negatives will be produced.

792. This developer can also be used for the developing of post-cards. For regular grade post-cards use one part of stock solution to two parts of water. For *special*, or cards that have soft printing qualities, dilute the developer about four parts—one part stock solution to four parts water. Keep the temperature of the solution about 65°, never under 60° or never over 70°.

793. **Controlling the Developer for Prints and Plates.**—Full control of contrast is secured by varying the dilution of the developer. Always bear in mind that the stronger the developer the softer the prints. When printing from a thin negative always dilute your developer, as this will enable you to produce more contrast. *Remember that this rule is reversed when developing plates*, as strong developers develop quicker, stronger and more contrasty, while diluted developers give softness.

794. **Plate Developing.**—Always bear in mind that the speed of development of the plate is entirely controlled by the amount of dilution of the developer. The more water you use the slower the plate will develop. The time of development can be made very short by using a full strength developer. Great care, however, must be exercised that exposures are even; in fact it is necessary that the plates should be fully timed, never under-exposed.

795. **Fixing.**—We would advise the use of a plain hypo bath for fixing. Use an extremely strong bath so that the plates will fix very rapidly. The acid fixing baths, made

up according to the formulæ given by the manufacturers of plates, can also be used. After a plate has been fixed, rinse for a few moments in fresh water and then place in the following solution: Formalin, (or 40% formaldehyde), one part to ten parts water. The formalin or 40% formaldehyde, can be purchased at any drug store.

796. Allow the plate to remain in this solution for a few seconds. Remove and again carefully rinse for a few moments, and then place in a bath of wood alcohol, diluting the wood alcohol about one-half with water. Allow the plate to remain for a few moments in this and then set up to drain. The alcohol which is left on the surface of the negative will slightly attack the celluloid which is placed over the wet negative, so that this covering which adheres to the face of the negative will make the latter waterproof.

797. **Printing from Wet Negatives.**—After the plate has been drained for a few minutes, place on the emulsion side a piece of thin transparent celluloid. The celluloid can be obtained from any film manufacturer or through your dealer.

798. Having treated the negative as above, now place it in a printing-frame of sufficient size to permit the shifting of the negative, cut-out and card, so that the portion of the negative desired can be printed on the postal. Print in the ordinary way, just the same as if the negative was dry. After the order has been printed from the negative, put it back in the washing tank for regular washing; then place in a rack to dry, after which file for duplicate orders. The post-cards are developed and fixed in the usual manner.

799. **Printing Light.**—Although there is very little danger of melting the film of the wet negative when treated with the formalin bath, yet it is advisable to take some precaution. Electric light is the most satisfactory illuminant, as it gives off a minimum amount of heat, and, as it is generally available, we recommend its use.

800. **Even Illumination.**—The negatives must be evenly illuminated. The proper distance from the light being equal to the diagonal of the print, the negative from

which postcards are to be printed should be at least $6\frac{1}{2}$ inches from the light.

801. **Home-Made Apparatus for Printing.**—The simplest form of printing apparatus is the electric incandescent bulb, gas jet or oil lamp, with a small platform constructed at proper height and correct distance from the light to give even illumination and uniform exposure to every print. If electric light is employed a stationary socket can be attached to the work table so that the bulb will be perpendicular. An upright block, against which to set the printing-frame, should be fastened on the table at a distance of about 8 inches from the light. To reduce the time required for giving full exposure it would be advisable to use a 32-candle power bulb. A switch, for turning the current on and off to make the exposure, will be an additional convenience, and will reduce the electric light bill. Another arrangement for an electric printing light is shown in Volume IV, page 210, its construction being described in paragraphs 689 and 690.

802. Still another simple and practical contrivance for printing from *wet* negatives without using a printing-frame is to arrange electric bulbs in the bottom of a box (having the box fit in the work table, with the top on a level with the table) and cover the top of the box with a sheet of ground-glass. The negative, covered with a thin sheet of clear celluloid, is placed on the ground-glass and the paper held in contact while printing, by employing the back of an ordinary printing-frame, hinging one end of it to a block located at the rear of the ground-glass. In addition to the regular bulbs a ruby bulb may be placed in the center of the bottom of the box. When the printing light is turned off the ruby light is automatically switched on, thus enabling the printer to adjust the postcard on the negative before printing.

803. **Printing Machines.**—Countless suggestions have been advanced for various home-made printing machines; so it is not necessary for details to be given here. Further than this, there are on the market practical printing ma-

chines constructed to fill the most exacting requirements of the printer of developing paper.

804. Among the electric printing machines on the market are the following: Reimers' Electric Contact Printing Machine; McIntire Photo Printer; Ingento Rapid Frame; The Vote-Berger Contact Printing Frame; The Kilborn Automatic Electric Printer; The Artura Printing Machine; Courtright's Automatic Printer, and The Dick Printer. These are all practical machines, involving principles which have proven to cover in one way or another the requirements of the photographer who desires to turn out large quantities of postcards or developing paper prints.

805. **Washing.**—After fixing, the cards should be washed by placing them on an inclined piece of glass; then with a rubber hose spray the cards for a few minutes, spraying both sides. After five minutes washing the prints can be dried in the following manner:

806. **Quick Drying Box.**—Construct a box or cupboard of fairly good size—say, 3 x 4 feet—with a cover or door which can be let down. An ordinary large packing case will answer the purpose very well. To two sides of the box nail strips of wood about six to eight inches apart, these strips serving as supports for the stretchers on which the cards are to be laid. Construct a number of stretchers, to fit into the box so that they can be slid in and out on the supporting strips, and cover them with cheese-cloth.

807. Although requiring longer time to construct them, a better form of stretcher can be made by interlacing white twine across the stretcher, much in the same way as a tennis racket is made. The cards will dry quicker than when laid on cheese-cloth.

808. The drying box should be built about two feet from the floor. The door of the box should be made to drop down and form a table. Cover the inside of the door with two layers of clean, pure blotters and over this tack a sheet of cheese-cloth. When the cards are taken from the wash water, lay them face up on the door, and with a strip of clean cheese-cloth wipe off the moisture from the face;

then place the cards, face down, on the stretchers, to dry.

809. Cut a large hole in the bottom of the box and cover the opening with a sheet of perforated metal—zinc or sheet iron. Under this set a lamp, the heat from which will rise and circulate between the stretchers and dry the cards very quickly. A large funnel over the lamp will materially assist in collecting the heat rays.

810. Where the arrangements of the gallery will permit, it will facilitate handling of the cards if the drying box is built with the back of the box facing the office, so that it can be reached from the business counter. A second door in the box, constructed to open from the counter, is then used to take out the dry cards, which avoids running to and fro from the dark-room.

811. **Overcoming Abrasion Marks.**—Abrasion marks frequently appear on post-cards, especially where a vignette or mask has been used. This you can overcome by adding ten grains of iodide of potassium to each fluid ounce of developer. These abrasion marks can also be removed from the cards or prints after they become dry (and only after they have become dry) by rubbing with a soft cloth or tuft of absorbent cotton dampened with wood alcohol.

812. **Preparing the Celluloid Film.**—In order that the celluloid will lay out flat without buckling or cockling, it should be placed for one hour in glycerin. The glycerin will make it very soft and pliable. The celluloid must, however, be allowed to dry before placing it in contact with your wet negatives.

813. **Cleaning Celluloid Film.**—As the film becomes soiled and greasy from constant use, and by coming in contact with the wet surface of the negative, which latter, not having been properly washed, contains hypo, it is necessary that the celluloid be washed occasionally. This can be done in clean water, with a subsequent soaking in glycerin.

814. **Numbering Negatives and Cards.**—After making a sitting, place the number of the negative (writing with a soft or indelible pencil) on the film side of the plate, being

careful that the number be placed on the extreme edge. This number must correspond with the receipt and number given the customer when the name is entered on the studio register. When making the prints place the number on one of the cards, on the address side, about where the stamp would be placed. This will enable the sorting of the orders and insure against mistakes when delivered.

815. Keeping Track of Sitzings and Orders.—You should provide yourself with checks similar to those used at amusement parks. These checks are printed and numbered in duplicate. The check is perforated in the center; one-half is retained by the customer and is presented at the office when calling for the pictures, and the other half is handed to the operator, who immediately places the check under a specially provided little spring clip attached to the back of the plate-holder at the time of making your sitting. The party changing plates marks the number on the plate to correspond with the check, and at the same time places the plate in the developing tank and starts the order on its way to finishing.

816. Manipulation.—The speed of the developer is usually about six to eight minutes. The fixing bath is very strong and should fix in five to six minutes. Plates are placed from the developing tank immediately into the fixing tank. From the fixing tank the plates are quickly rinsed and dipped in the formalin for only a moment; then again rinsed thoroughly and dipped in the alcohol bath, when they are set in the rack to drain for a few seconds. The celluloid is then placed in contact with the wet negative and both placed in the printing-frame and the order printed. The cards are fixed for five minutes and washed by a spray of the hose for one minute, then dried, sorted and delivered.

817. Enlarging Method of Making Post-Cards.—Another method much in vogue, and, by some, considered the quicker, is the enlarging from a very small image on to a bromide card. This method requires extra apparatus in the dark-room, in the shape of a small enlarging lantern and a post-card easel. The regular small projecting lanterns

will serve for the purpose, but special lanterns can be bought for a comparatively small sum. Burke & James make a lantern which is very adaptable for the purpose. The post-card easel is a small wooden frame, into which the cards can be quickly slid and withdrawn after the exposure has been made. The procedure is as follows:

818. A small plate is used, usually $2\frac{1}{4}$ inches square. This is quickly developed in the manner previously given, fixed, rinsed for a minute, and then the moisture wiped off both film and back of plate with a pad of cotton (the negative is not dipped into the alcohol bath). The negative is then placed in the holder in the lantern, and, after setting the easel at the correct distance from the negative, the bromide post-cards are slipped, one after the other, into the frame, a cap over the lens being used to effect the exposures. With a powerful light a second or two will suffice for the exposure. The cards are then quickly developed, fixed, washed, and dried in the manner already described. By this method the cards can be delivered in fifteen minutes, or less, from the time of exposure of the plate. Of course, bromide cards must be employed; gaslight or developing cards cannot be used in this way.

819. Care must be taken that the light from the lantern is protected or the cards and the plates will be fogged. After the post-cards have been made the negatives go back into the washing tank and are, after drying, available for future orders. The negative should be made as sharp as possible, to allow for the slight diffusion of the image which will result when enlarging on the post-card.

CHAPTER XXXVII

Ping Pong and Penny Pictures

As a means of catching the dimes and quarters of the young element, school children and visitors at resorts, the ping pong and penny pictures were inaugurated, with the result that this class of picture has become very popular and the making of them a very profitable business. To meet the requirements different camera manufacturers are now making suitable instruments, at a nominal cost, by means of which pictures can be sold for a penny each and give the photographer a good profit.

The term "**Penny**" Pictures is somewhat misleading, for they are really penny pictures in name only as a single picture could not be made for one cent. They are made and sold only in quantities, at the rate of one cent each. Usually the photographer supplies fifteen pictures for fifteen cents, no orders being taken for less than fifteen pictures.

Ping Pong Pictures are smaller than the penny pictures, and are usually made in strips of a half dozen, delivered unmounted or what is known as a "slip mount". The aim of the photographer should be to sell mounts to his patrons for these pictures, they oftentimes bringing more money and more profit than the pictures themselves.

General Principles.—Instead of making one exposure on a single plate for this type of picture, the apparatus is so constructed that a 5x7 plate can be placed in a vertical or a horizontal position and either one, two, four, six, eight, twelve, fifteen, eighteen or twenty-four exposures made on

the one plate. The object is to make a large number of exposures on one plate, and after it is developed to print as many full size sheets of paper as the proposition calls for. As an example: If you have fifteen different exposures on one plate, and if you are offering fifteen prints for fifteen cents, then fifteen prints are made from it. This completes fifteen orders of fifteen pictures each, for which you receive fifteen cents each, or \$2.25 for fifteen prints from one 5x7 plate.

To make the "penny picture" business a success, various methods must be used to increase the receipts. The prints can be finished in a variety of styles, and different positions can be made; in fact there is almost an endless number of methods that may be adopted. For instance, if fifteen pictures are sold for fifteen cents, one position only is allowed to each subject. Where different positions are wanted, twenty-five cents is usually charged, and three exposures made of five different subjects, on one plate (fifteen exposures altogether), from which only five prints are to be made. These five prints, therefore, bring you \$1.25. Figuring the cost of the plate at six cents, the five sheets of paper at ten cents, and the plain cards at three cents, the total cost has been but nineteen cents. Card mounts of a better quality are usually sold with the higher class of work, and in addition to paying for themselves result in a greater profit than is made when cheap cards are used. The mounts, therefore, should be given consideration.

The actual work and the methods employed in producing the so-called ping pong or penny pictures—making and developing of negatives and final finishing of prints—are practically the same as in any regular studio. Most of the ping pong studios, however, are not supplied with the regular skylight, but an ordinary room, containing one or two fairly good size windows, is selected, and the methods of the home portrait photographer are employed in making the lightings.

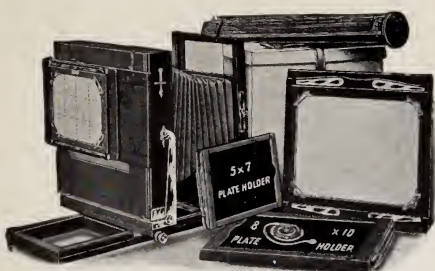


Illustration No. 132.
Seneca Penny Picture Outfit.

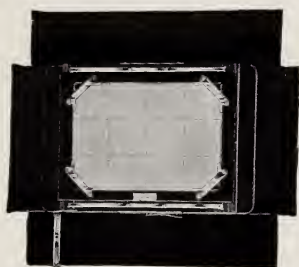


Illustration No. 133.
Seneca Multiplying Attachment.

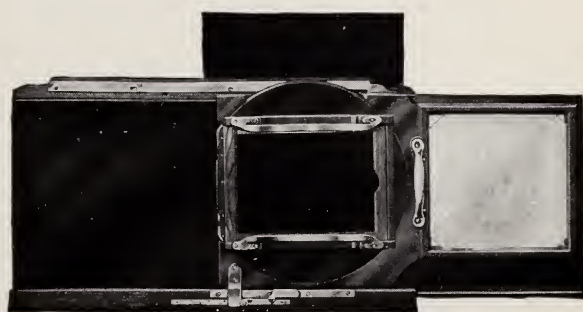


Illustration No. 134.
B. & J. Multiplying Attachment.



Illustration No. 135
A Practical Suburban Studio
Chas. W. Allen, South Granby, N. Y.

Equipment.—The necessary equipment consists of a multiplying camera, camera stand, a few plate holders and a few trays for developing the plates and finishing the prints.

As only bust or half-length figures are all the ping pong photographer attempts, only one or two small plain backgrounds is all that is necessary. Generally two are used, a light one and a dark one. Comical make-ups are a novel feature of ping pong pictures, so one's list of accessories might be increased and a few costumes added, such as odd hats, a dilapidated silk hat, an old style derby, canes, false moustaches, or any other paraphernalia that might be used in a stage make-up.

The Camera.—There are on the market various types of cameras which may be procured at a very reasonable figure, any of which will answer the purpose. These cameras are specially arranged for the making of a number of small pictures on one plate. In Illustration No. 132 is shown the Seneca View camera, to which is fitted a Multiplying Back, which latter is shown more in detail in Illustration No. 133. This instrument, in addition to being available for penny or ping pong pictures, can also be used for cabinet size portrait work or postal cards, as well as for view work. The B. & J. Multiplying Attachment shown in Illustration No. 134 can be adjusted to any ordinary portrait camera. Both of these attachments are simply constructed, easily operated, and form good examples of the general type of outfits on the market.

Camera Stand.—While any regular portrait camera stand, or even the regulation tripod intended for view cameras, may be employed, yet when the stand is preferred, one light in weight, that can be "knocked down" should be selected, for then it may be boxed in a small space for shipment.

Lens.—Any lens may be used, but, naturally, one of

short focus and good speed should be chosen. The manufacturers of cameras equip their outfits with or without lenses, and also supply the lenses separately, at a moderate cost.

Lighting the Subject.—Under the ordinary studio skylight the subjects usually are placed in open light. When the ordinary window is employed a room is generally selected with the window facing the north. The subject is placed within a few feet of the window and slightly back of it, so as to receive the full benefit of all the light entering. The usual background is placed back of the subject. When but one style of picture is made, all subjects are seated, and, generally, the chair is made stationary. This avoids the necessity of focusing on each subject, for when once in focus the camera will need no further adjusting, no matter how many different subjects are photographed.

Operating the Multiplying Attachment.—The manufacturers of cameras and multiplying attachments supply complete instruction for their use, which is so very simple that further mention here is unnecessary.

Development and Finishing.—Tank development is usually employed for this class of work, complete instruction for which is given in Volume II of this library.

Printing.—Either glossy printing-out paper or glossy gaslight paper is used for penny and ping pong pictures. Complete instruction for their manipulation will be found in Volume IV.

Mounting Prints.—In order to obtain a high gloss the prints are squeegeed onto ferrotype plates. After rolling the sheet print and the ferrotype plate into contact, mopping off the surplus water, apply ordinary mucilage to the back of the prints and allow them to dry. Then they may be cut apart, the backs moistened with a damp sponge, and, like an ordinary postage stamp, attached to the mount.

If slip mounts are used it is not necessary to apply mucilage to the back of the print.

Ping pong pictures are generally made in strips of five exposures, and are delivered unmounted. When mounted usually the slip mounts are employed; they require no pasting.

General Notes.—The making of ping pong or penny pictures is entirely mechanical in every respect, and each exposure must be accounted for.

There must be no re-sittings, no proofs shown, and the pictures taken on one day should be ready for delivery the next.

Get all the extra money you can by selling mounts.

Keep on hand a variety of different styles and prices of mounts.

These pictures are seldom ever retouched. When it is requested an extra charge should be made for the retouching.

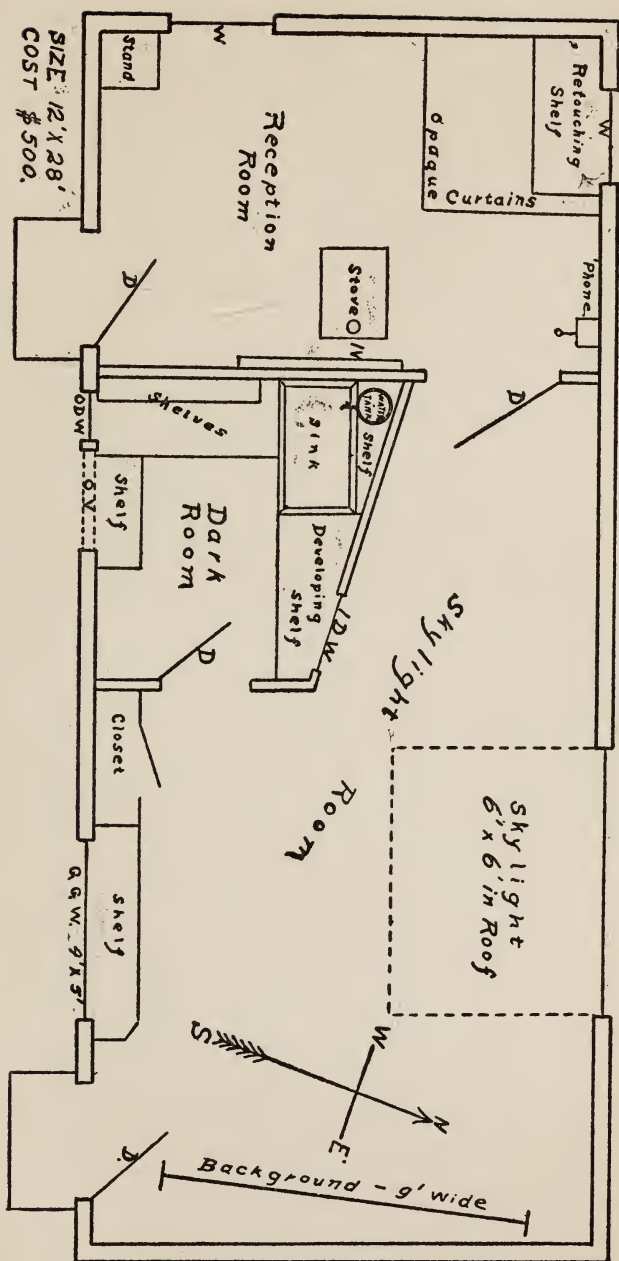
Advertising.—A very common method of advertising is to place on the front of the building a large canvas sign, reading: "Your photograph for one cent." On all such orders you would make fifteen pictures, one position, mounted on cheap cards, for fifteen cents. In some localities you may see signs which read, "Your photograph for 5 cents," or possibly 10 cents. In such cases they usually make a trifle larger picture, or, perhaps, more than one position, and make each order amount to fifty cents. If they should advertise five-cent pictures, they would supply ten prints for 50 cents, and in the case of ten-cent pictures, they would supply five for 50 cents, or twelve for \$1.00. The price of such photos will need be fixed according to circumstances and location.

As previously stated, the money in penny and ping pong pictures lies in the quantities ordered and in the selling of suitable mounts for the prints. Slip mounts are to be preferred, as they save the bother of pasting and mount-

ing, for the prints and mounts are usually delivered in separate packages, leaving the slipping of the pictures into the mounts to the customers themselves. The slip mounts are very attractive little mats, many of them having embossed borders, with openings displaying one, two, three, four or five faces, either oval or square, and they are designed to take the place of "paste on" mounts. The print being inserted saves much time in mounting. Of course the regular mounts may be employed, but slip mounts give a finished appearance to the photographs far superior to the plain ones, on which the prints have to be pasted.

A novel method of advertising is to circulate small cards among school children, these cards to be neatly printed, bearing some inscription similar to the following: "I am going to have my pictures taken at the Gem Studio, to exchange with my schoolmates, 15 for 25 cents, five positions, and get those pretty cards to mount them on." To make this card more attractive have a small half-tone of some cute picture printed on one corner of the card, and have your address in neat type at the bottom.

A Practical Suburban Studio.—In Illustration No. 135 is shown a neat and very convenient little studio, which is practical for use in suburban localities, small cities and villages. This particular one was constructed in accordance to the floor plan shown in Illustration No. 136, at a cost of \$500, the size being 12 x 28 feet. The general arrangement is plain. The business can be handled by one man, so that expenses can be reduced to a minimum.



SIZE 12' x 28'
COST \$500.

Illustration No. 136.
A Practical Suburban Studio—Floor Plan.
Chas. W. Allen, So. Granby, N. Y.

CHAPTER XXXVIII.

How the Studies Illustrating This Volume Were Made.

Illustration No. 2. Plate—Cramer Crown. Lens—Dallmeyer Rapid Rectilinear, 16-inch focal-length. Stop—U. S. 32. Time of day—11 A. M. Exposure— $\frac{1}{2}$ second. Developer—hydroquinon. (See Page 41.)

Illustration No. 3. Plate—Standard Orthochromatic. Lens—Single combination of Bausch & Lomb-Zeiss 7-A, focal-length 24 inches. Stop—U. S. 64. Time of day—4 P. M., sun shining brightly. Exposure—one second. Developer—pyro. This illustration was from an 11 x 14 print. (See Page 42.)

Illustration No. 4. Plate—Standard Orthochromatic. Lens—Dallmeyer Rapid Rectilinear, focal-length 16 inches. Stop—U. S. 64. Time of day—12 M., sun shining brightly. Exposure—one second. Developer—pyro. (See Page 45.)

Illustration No. 5. Plate—Standard Orthochromatic. Lens—Bausch & Lomb-Zeiss 7-A, focal-length 14 inches. Stop—U. S. 16. Time of day—5 P. M., bright sunshine. Exposure—1-5 second. Developer—pyro. (See Page 46.)

Illustration No. 6. Plate—Standard Orthochromatic. Lens—Single combination of Bausch & Lomb-Zeiss 7-A, focal-length 14 inches. Stop—U. S. 32. Time of day—11 A. M., sun shining brightly. Exposure—1-5 second. Developer—pyro. (See Page 47.)

Illustration No. 7. Plate—Standard Orthochromatic. Lens—Dallmeyer Rapid Rectilinear, focal-length 16 inches. Bausch & Lomb ray filter. Stop—U. S. 64. Time of day—1:30 P. M., bright sunshine. Exposure—one second. Developer—pyro. (See Page 48.)

Illustration No. 8. Plate—Cramer Crown. Lens—

Dallmeyer Rapid Rectilinear, focal-length 16 inches. Stop—U. S. 64. Time of day—11 A. M., bright sunshine. Exposure—one second. Developer—metol-hydroquinon. (See Page 51.)

Illustration No. 9. Plate—Cramer Crown. Lens—Dallmeyer Rapid Rectilinear, focal-length 16 inches. Stop—U. S. 64. Time of day—5 P. M., bright sunshine. Exposure—one second. Developer—pyro. (See Page 52.)

Illustration No. 10. Plate—Cramer Crown. Lens—Dallmeyer Rapid Rectilinear, focal-length 16 inches. Stop—U. S. 32. Time of day—3 P. M. Exposure— $\frac{1}{2}$ second. Developer—pyro. (See Page 55.)

Illustration No. 11. Plate—Cramer Crown. Lens—Dallmeyer Rapid Rectilinear, focal-length 16 inches. Stop—U. S. 64. Time of day—11 A. M., bright sunshine. Exposure—one second. Developer—pyro. (See Page 56.)

Illustration No. 16. Plate—Standard Orthochromatic. Lens—Standard Wide-angle Anastigmat, focal-length 7 inches. Stop—U. S. 64. Time of day—3 P. M., cloudy. Exposure—20 minutes. Developer—pyro. (See Page 75.)

Illustration No. 17. Plate—Standard Orthochromatic. Lens—Standard Wide-angle Anastigmat, focal-length 7 inches. Stop—U. S. 64. Time of day—10 A. M., cloudy. Exposure—10 minutes. Developer—pyro. (See Page 76.)

Illustration No. 18. Plate—Standard Orthochromatic. Lens—Bausch & Lomb-Zeiss Wide-angle, focal-length $7\frac{1}{2}$ inches. Stop—U. S. 64. Time of day—3 P. M. Exposure—30 minutes. Developer—pyro. (See Page 77.)

Illustration No. 19. Plate—Standard Orthochromatic. Lens—Bausch & Lomb-Zeiss Wide-angle, focal-length $7\frac{1}{2}$ inches. Stop—U. S. 32. Time of day—3 P. M. Exposure—15 minutes. Developer—pyro. (See Page 78.)

Illustration No. 20. Plate—Standard Orthochromatic. Lens—Bausch & Lomb-Zeiss Wide-angle, focal-length $7\frac{1}{2}$ inches. Stop—U. S. 32. Time of day—3:30 P. M., snow outdoors. Exposure—20 minutes. Developer—pyro. (See Page 79.)

Illustration No. 21. Plate—Standard Orthochromatic.

Lens—Bausch & Lomb-Zeiss Wide-angle, focal-length $7\frac{1}{2}$ inches. Stop—U. S. 64. The day was dull. Exposure—30 minutes. Developer—pyro. (See Page 80.)

Illustration No. 22. Plate—Standard Orthochromatic. Lens—Standard Wide-angle Anastigmat, focal-length 7 inches. Stop—U. S. 64. Day was cloudy. The illumination was from a transom above the hall door and from a side window. Exposure—1 hour, 20 minutes. Developer—pyro. (See Page 83.)

Illustration No. 23. Plate—Hammer Non-halation. Lens—Dallmeyer Wide-angle Rapid Rectilinear, focal-length 8 inches. Stop—U. S. 64. Time of day—2 P. M., cloudy. The light was from a transom over a door back of the camera. Exposure—1 hour, 20 minutes. Developer—metol-hydroquinon. (See Page 84.)

Illustration No. 24. Plate—Hammer Non-halation. Lens—Dallmeyer Wide-angle Rapid Rectilinear, focal-length 8 inches. Stop—U. S. 64, bright outdoors. The illumination came from a large skylight, a portion of which is included in the view. Exposure—30 seconds. Developer—metol-hydroquinon. (See Page 85.)

Illustration No. 25. Plate—Standard Orthochromatic. Lens—Bausch & Lomb-Zeiss Wide-angle, focal-length $7\frac{1}{2}$ inches. Stop—U. S. 64. Time of day—9 A. M. Exposure—10 minutes. Developer—pyro. (See Page 86.)

Illustration No. 26. Plate—Standard Orthochromatic. Lens—Bausch & Lomb-Zeiss Wide-angle, focal-length $7\frac{1}{2}$ inches. Stop—U. S. 64. Time of day—10 A. M., cloudy. Exposure—10 minutes. Developer—pyro. (See Page 87.)

Illustration No. 27. Plate—Standard Orthochromatic. Lens—Bausch & Lomb-Zeiss Wide-angle, focal-length $7\frac{1}{2}$ inches. Stop—U. S. 64. Time of day—9:30 A. M., dull. Exposure—10 minutes. Developer—pyro. (See Page 88.)

Illustration No. 28. Plate—Standard Orthochromatic. Lens—Bausch & Lomb-Zeiss, focal-length 14 inches. Stop—U. S. 64. Time of day—2 P. M. Exposure—10 seconds. Developer—pyro. (See Page 91.)

Illustration No. 29. Plate—Hammer Non-halation.

Lens—Dallmeyer Wide-angle Rapid Rectilinear, focal-length 8 inches. Stop—U. S. 64. Time of day—2 P. M., bright. Exposure—5 minutes. Developer—metol-hydroquinon. (See Page 92.)

Illustration No. 30. Plate—Standard Orthochromatic. Lens—Dallmeyer Rapid Rectilinear, focal-length 16 inches. Stop—U. S. 64. Time of day—11 A. M. Exposure—30 minutes. Developer—pyro. (See Page 93.)

Illustration No. 31. Plate—Standard Orthochromatic. Lens—Bausch & Lomb-Zeiss, focal-length 14 inches. Stop—U. S. 64. Time of day—3 P. M., bright. Exposure—14 minutes. Developer—pyro. (See Page 94.)

Illustration No. 32. Plate—Standard Orthochromatic. Lens—Bausch & Lomb-Zeiss, focal-length 14 inches. Stop—U. S. 64. Time of day—10 A. M., cloudy. Exposure—20 minutes. Developer—pyro. The rear of the room was illuminated by means of magnesium ribbon. (See Page 97.)

Illustration No. 33. Plate—Standard Orthochromatic. Lens—Bausch & Lomb-Zeiss Wide-angle, focal-length $7\frac{1}{2}$ inches. Stop—U. S. 64. Time of day—12:30 P. M., dull. Exposure—15 minutes. Developer—pyro. (See Page 98.)

Illustration No. 34. Plate—Standard Orthochromatic. Lens—Bausch & Lomb-Zeiss, focal-length 14 inches. Stop—U. S. 64. Time of day—10 A. M., cloudy. Exposure—20 minutes. Developer—pyro. (See Page 101.)

Illustration No. 35. Plate—Standard Orthochromatic. Lens—Bausch & Lomb-Zeiss 7-A, focal-length 14 inches. Stop—U. S. 32. Time of day—10 A. M., cloudy. Exposure—3 minutes. Developer—pyro. (See Page 102.)

Illustration No. 35a. Plate—Standard Orthochromatic. Lens—Bausch & Lomb-Zeiss 7-A, focal-length 14 inches. Stop—U. S. 16. Time of day—4:30 P. M., bright sunshine on window. Developer—pyro. (See Page 103.)

Illustration No. 35b. Plate—Standard Orthochromatic. Lens—Bausch & Lomb-Zeiss, focal-length 14 inches. Stop—U. S. 32. Time of day—9 A. M., dull. Exposure—5 minutes. Developer—pyro. (See Page 104.)

Illustration No. 36. Plate—Hammer Non-halation.

Lens—Dallmeyer Wide-angle Rapid Rectilinear, focal-length 8 inches. Stop—U. S. 64. Time of day—4 p. m., bright. Exposure—20 minutes. Developer—metol-hydroquinon. (See Page 108.)

Illustration No. 37. Plate—Standard Orthochromatic. Lens—Dallmeyer Wide-angle Rapid Rectilinear, focal-length 8 inches. Stop—U. S. 64. Time of day—4 p. m., bright. Exposure—10 minutes. Developer—pyro. (See Page 109.)

Illustration No. 38. Plate—Standard Orthochromatic. Lens—Standard Wide-angle Anastigmat, focal-length 7 inches. Stop—U. S. 64. Time of day—4:30 p. m. Exposure—3 minutes. Developer—pyro. (See Page 110.)

Illustration No. 39. Plate—Standard Orthochromatic. Lens—Bausch & Lomb-Zeiss, focal-length 14 inches. Stop—U. S. 16. Time of day—5 p. m. Exposure—15 minutes. Developer—pyro. (See Page 111.)

Illustration No. 40. Plate—Standard Orthochromatic. Lens—Clark, focal-length 14 inches. Stop—U. S. 32. Time of day—10 a. m. The majority of the light came from the large skylight, yet the illumination of the shadows was assisted by a small flash of magnesium after the exposure of 20 minutes had been given. Developer—pyro. (See Page 112.)

Illustration No. 41. Plate—Standard Orthochromatic. Lens—Clark Rapid Rectilinear, focal-length 14 inches. Stop—U. S. 32. Time of day—10 a. m., bright. Exposure—10 seconds, assisted by a heavy flash of pure magnesium. Developer—pyro. (See Page 113.)

Illustration No. 42. Plate—Standard Orthochromatic. Lens—Clark Rapid Rectilinear, focal-length 14 inches. Stop—U. S. 32. Time of day—2 p. m. Exposure—20 seconds, assisted by a heavy flash of pure magnesium. Developer—pyro. (See Page 114.)

Illustration No. 43. Plate—Standard Orthochromatic. Lens—Clark Rapid Rectilinear, focal-length 14 inches. Stop—U. S. 32. Illumination— $\frac{1}{2}$ ounce Luxo flash-powder. Developer—pyro. (See Page 117.)

Illustration No. 44. Plate—Standard Orthochromatic. Lens—Dallmeyer Rapid Rectilinear, focal-length 16 inches. Stop—U. S. 64. Time of day—11 A. M., cloudy. Exposure—one second. Developer—pyro. (See Page 118.)

Illustration No. 46. Plate—Standard Orthochromatic. Lens—Dallmeyer Rapid Rectilinear, focal-length 16 inches. Stop—U. S. 64. Time of day—3 P. M., cloudy. Exposure—20 seconds. Developer—pyro. The camera was pointing up into the dome with the ground-glass laying flat on the floor. (See Page 121.)

Illustration No. 47. Plate—Standard Orthochromatic. Lens—Dallmeyer Rapid Rectilinear, focal-length 16 inches. Bausch & Lomb Ray Filter. Stop—U. S. 32. Time of day—2 P. M. Exposure—10 minutes. Developer—pyro. This ceiling photograph was made by guessing at the center of the picture and pointing the lens straight up, having the camera on the floor, the focus being secured by measurement. (See Page 122.)

Illustration No. 48. Plate—Standard Orthochromatic. Lens—Bausch & Lomb-Zeiss 7-A, focal-length 14 inches. B. & L. Ray Filter. Stop—U. S. 16. Time of day—4 P. M., dull. Exposure—30 seconds. Developer—pyro. (See Page 125.)

Illustration No. 49. Plate—Standard Orthochromatic. Lens—Clark Rapid Rectilinear, focal-length 14 inches. Stop—U. S. 32. Time of day—9 A. M., cloudy. Exposure—10 minutes. Developer—pyro. (See Page 126.)

Illustration No. 50. Plate—Standard Orthochromatic. Lens—Clark Rapid Rectilinear, focal-length 14 inches. Stop—U. S. 32. Time of day—11 A. M., cloudy. Exposure—15 minutes. Developer—pyro. (See Page 129.)

Illustration No. 52. Plate—Standard Orthochromatic. Lens—Standard Wide-angle Anastigmat, focal-length 7 inches. Stop—U. S. 64. The day was cloudy. Exposure—20 minutes. Developer—pyro. (See Page 141.)

Illustration No. 53. Plate—Standard Orthochromatic. Lens—Clark Rapid Rectilinear, focal-length 14 inches. Stop—U. S. 64. Time of day—3 P. M., dull. Exposure—

20 minutes. Developer — metol-hydroquinon. (See Page 145.)

Illustration No. 54. Plate—Standard Orthochromatic. Lens—Bausch & Lomb-Zeiss Wide-angle, focal-length $7\frac{1}{2}$ inches. Stop—U. S. 32. Time of day—2 P. M., bright. The light came from two small windows. Exposure—15 minutes. Developer—pyro. (See Page 149.)

Illustration No. 84. Plate—Cramer Crown. Lens—Voigtländer, focal-length 14 inches. Stop—U. S. 32. Time of day—4 P. M. Exposure— $\frac{1}{2}$ second. Developer—pyro. (See Page 221.)

Illustration No. 85. Plate—Cramer Crown. Lens—Voigtländer Rectilinear, focal-length 14 inches. Stop—U. S. 32. Time of day—3:30 P. M. Exposure—1.5 second. Developer—pyro. (See Page 222.)

Illustration No. 92. Plate—Standard Orthochromatic. Lens—Rapid Rectilinear, focal-length 18 inches. Stop—U. S. 32. The illumination—4 ounces Luxo flash-powder. Developer—pyro. This picture was made under somewhat unusual circumstances, a studio camera having a curtain-slide plate-holder being used. The camera and flash machine were arranged and both loaded at 5 P. M. A member of the order who knew practically nothing of photography was instructed to pull the slide, take off the lens cap and pull the spring to ignite the flash-powder; then replace the cap and slide and leave the apparatus as it stood to be removed by the photographer. He followed the instructions perfectly, making the exposure at 8:30 P. M. The camera and flash machine remained in place until 11 o'clock. The plate was developed the next morning, resulting in an excellent flashlight negative. Although a couple of professional photographers were in attendance, it was preferred to allow a person entirely unfamiliar with photography to make the exposure, as such a person with a cool head would follow the instructions closely and not use his own ideas which might not coincide with the photographer in charge of the work. (See Page 237.)

Illustration No. 92a. Plate—Standard Orthochromatic.

Lens—Bausch & Lomb-Zeiss, focal-length 14 inches. Stop—U. S. 64. Walls of the building—white. Time of day—4 P. M. Illumination—one ounce Luxo flash-powder. Developer—pyro. (See Page 238.)

Illustration No. 95. Plate—Seed No. 26. Lens—Dallmeyer Rapid Rectilinear, focal-length 16 inches. Stop—U. S. 32. Exposure—3 ounces of flash-powder. Size of plate—14 x 17 inches. Developer—pyro. (See Page 261.)

Illustration No. 99. Plate—Cramer. Lens—Dallmeyer Rapid Rectilinear, focal-length 16 inches. Stop—U. S. 32. Time of day—9 A. M., cloudy and weather cold. Exposure— $\frac{1}{2}$ second. Developer—metol-hydroquinon. (See Page 269.)

Illustration No. 100. Plate—Hammer. Lens—Dallmeyer Wide-angle Rapid Rectilinear, focal-length 8 inches. Stop—U. S. 64. Time of day—11 A. M., cloudy. Exposure—one second. Developer—metol-hydroquinon. (See Page 270.)

Illustration No. 52*a* was made at 3:30 P. M., on a bright day, the windows facing northeast. Plate used was an 8 x 10 Standard; lens used was a $6\frac{1}{2} \times 8\frac{1}{2}$ Schrieffer Rectilinear, stopped down to U. S. 64; exposure given, 20 seconds. The plate was developed with pyro, according to formula and instructions given in Chapter XIII, Volume II, Special Developing for Commercial Photography.

To develop I took 1 ounce of No. 1, 1 ounce of No. 2, and 8 to 10 drops of No. 3, and about 18 ounces of water. As the development advanced I added, every few minutes, a few drops of No. 3. The No. 3 was added only as the development seemed to have stopped. Complete development was accomplished in 30 minutes.

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